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NATIONAL DAM INSPECTION PROGRAM. EISENHUTH DAM (NDS PA-00662/DE--ETC(U)
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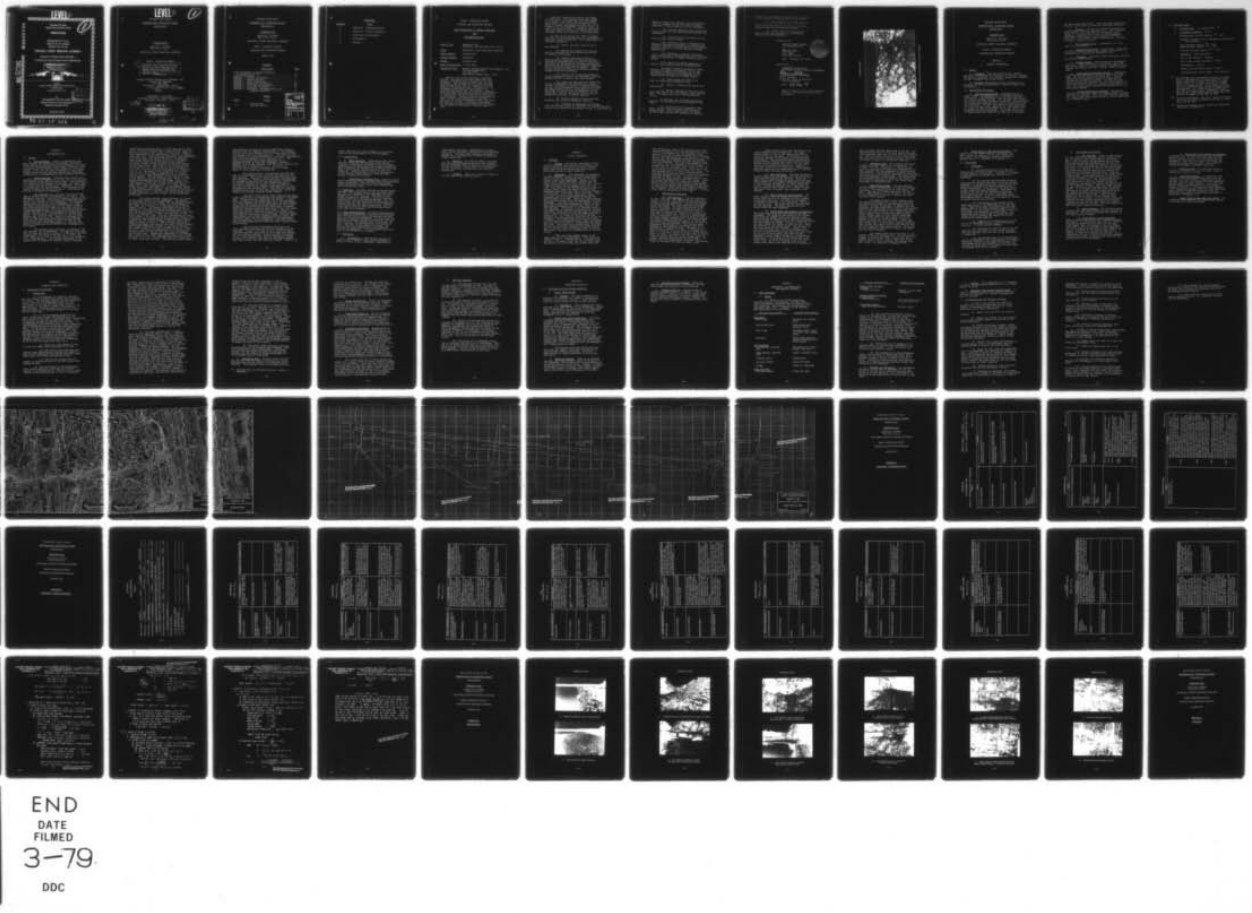

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DELAWARE RIVER BASIN
EISENHUTH RUN, SCHUYLKILL COUNTY

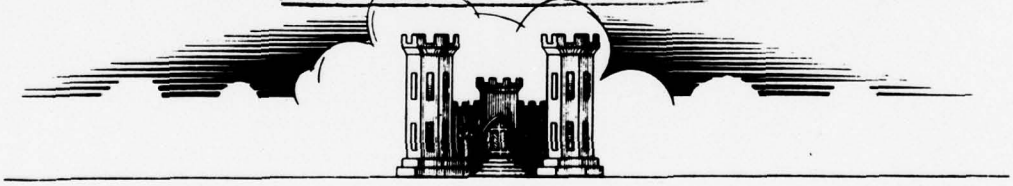
PENNSYLVANIA

EISENHUTH DAM

NDS ID NO. PA-00662
DER ID NO. 54-55

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



Prepared by
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

AUGUST 1978

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LEVEL II

DELAWARE RIVER BASIN

EISENHUTH RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

EISENHUTH DAM

NDS ID No. PA-00662
DER ID No. 54-55

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM,
Eisenhuth Dam (NDS PA-00662/DER 54-55),
Delaware River Basin, Eisenhuth Run,
Schuylkill County, Pennsylvania. Phase I
Inspection Report.

Prepared by

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
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Contract No. DACW31-78-C-0046

For

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

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AUGUST 1978

DELAWARE RIVER BASIN

EISENHUTH RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

EISENHUTH DAM

NDS ID No. PA-00662
DER ID No. 54-55

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Eisenhuth Dam NDS ID No. PA-00662/DER ID No. 54-55
Owner:	Schuylkill County Municipal Authority
State Located:	Pennsylvania
County Located:	Schuylkill
Stream:	Eisenhuth Run
Date of Inspection:	17 July 1978
Inspection Team:	Gannett Fleming Corddry and Carpenter, Inc. Consulting Engineers P.O. Box 1963 Harrisburg, Pennsylvania 17105

Based on the visual inspection, available records, calculations and past operational performance, Eisenhuth Dam is judged to be in fair condition. The spillway will not pass the Probable Maximum Flood (PMF) or one-half of the PMF without overtopping the dam. Overtopping of the embankment would cause erosion failure. If Eisenhuth Dam should fail, the hazard to loss of life downstream from the dam would be significantly increased from that which would exist just prior to overtopping. Based on criteria established for these studies by the Department of the Army, Office of the Chief of Engineers (OCE), the spillway capacity is rated as seriously inadequate. The existing spillway can accommodate a flood with a peak inflow of 28 percent of the PMF peak inflow.

Stability calculations were not performed for this study. The spillway weirs were judged to be stable. The combination of steep embankment slopes, particularly the downstream slope, which is bulged, and seepage are such that it is believed that the embankment stability factor of safety is close to unity. A change in conditions from those observed during this inspection could adversely affect the stability of the embankment.

In view of the concern for safety of Eisenhuth Dam, the following measures are recommended, in approximate order of priority, to be undertaken by the Owner immediately:

(1) Remove the brush from the spillway channels.

(2) Remove the roadway fill and culverts in the right spillway channel and provide an adequate watercourse.

(3) Perform additional studies to more accurately ascertain the spillway capacity required for Eisenhuth Dam, as well as the nature and extent of the mitigation measures required to make both the spillways and the channels downstream of the spillways hydraulically adequate. These studies should also address any erosion potential caused by spillway discharge.

(4) Install two or more inclinometers in the downstream slope of the embankment near the maximum section to monitor any slope movement.

(5) Clear the area along the downstream toe of the embankment and identify all seepage outlets. Construct a system of channels and weirs so that flow measurements can be made for all seepage points and so that any accumulation of soils that might be coming from the embankment can be recognized. Monitor and record data so that any change in conditions is readily apparent.

(6) Perform surveys to more accurately determine the existing embankment template.

(7) Undertake an embankment and foundation exploration program to ascertain the engineering properties of the materials and perform a study to determine the

factor of safety for stability of the embankment. Take any remedial action that might be found necessary to ensure stability of the embankment.

(8) Provide upstream closure facilities for all pipes that are under pressure beneath the embankment.

(9) Provide erosion protection in the left spillway outlet channel.

(10) Perform a study to determine the emergency drawdown requirements of Eisenhuth Dam, as well as the nature and extent of the mitigation measures required to provide emergency drawdown capabilities.

(11) Undertake a program of detailed annual inspections of Eisenhuth Dam and utilize the results to determine if remedial measures are required.

(12) Develop a detailed emergency operation and warning system for Eisenhuth Dam.

In order to correct operational, maintenance, and repair deficiencies, and to more accurately determine the condition of the dam, the following measures are recommended to be undertaken by the Owner in a timely manner:

(1) Remove brush and trees on or near the downstream embankment slope.

(2) Repair or replace the lock at the valve house.

(3) Monitor cracking at the left spillway bridge and at the left spillway right training wall. If changes are noted, take appropriate action.

In addition, the following operational measures are recommended to be undertaken by the Owner:

(1) During periods of unusually heavy rains, provide round-the-clock surveillance of Eisenhuth Dam. Until remedial work that makes the spillways hydraulically adequate is complete,

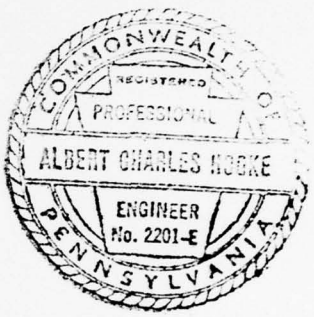
provide crews to remove any debris that may collect at the spillways during periods of high runoff.

(2) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

(3) Ensure that any future utility work, such as placing poles, is a sufficient distance from the embankment.

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.



A.C. HOOKE
Head, Dam Section

Date: September 20, 1978

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

G.K. WITHERS
Colonel, Corps of Engineers
District Engineer

Date: 23 Sep 78

Under the recently revised spillway evaluation guidelines, this dam is considered unsafe, non-emergency.

EISENHUTH DAM

Downstream Slope of Embankment from Right Abutment.

DELAWARE RIVER BASIN

EISENHUTH RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

EISENHUTH DAM

NDS ID No. PA-00662
DER ID No. 54-55

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SECTION 1

PROJECT INFORMATION

1.1. General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Eisenhuth Dam is a zoned earthfill embankment with two spillways and two outlet works. The embankment is 1,350 feet long and 45 feet high at maximum section. The spillways are located at the left and right abutments of the dam. Both spillways are broad-crested masonry weirs about 2.4 feet below the top of the dam. The left and right spillway crests are 31.5 and 38.9 feet long, respectively. One outlet works is located at the left abutment of the dam, and it is presently considered abandoned. The other outlet works is located near the center of the dam, and it contains

the water supply facilities. There are other facilities in this outlet works, but they are considered abandoned.

b. Location. The dam is located on Eisenhuth Run approximately 3.8 miles northeast of St. Clair, Pennsylvania, and 6.1 miles northeast of Pottsville, Pennsylvania. Eisenhuth Dam is shown on USGS Quadrangle, Shenandoah, Pennsylvania, with coordinates N40°46'55" - W76°10'45" in Schuylkill County, Pennsylvania. The location map is shown on Plate 1.

c. Size Classification. Intermediate (45 feet high, 1,091 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Eisenhuth Dam (Paragraph 5.1e.).

e. Ownership. Schuylkill County Municipal Authority, Pottsville, Pennsylvania.

f. Purpose of Dam. Water supply for the communities of St. Clair, Pottsville, Port Carbon, Shanetown, East Mines, Wadesville, East Norwegian, Norwegian, North Manheim, New Castle, Palo Alto, and Mt. Carbon, Pennsylvania.

g. Design and Construction History. Information concerning the designer of Eisenhuth Dam was not available. The dam was constructed about 1875. No other information concerning the design and construction history was available for review. In 1962, the left spillway bridge was modified. No other known modifications have occurred since the original construction. In 1961, the present Owner acquired the dam from the Pottsville Water Company.

h. Normal Operational Procedure. The pool is maintained at spillway crest with excess inflow discharging over the spillway. Water is drawn from the reservoir by a water supply pipe which extends 3.6 miles downstream to a treatment plant.

1.3 Pertinent Data.

a. Drainage Area. 2.0 square miles. (1)

b. Discharge at Damsite. (cfs.)

Maximum known flood at damsite (2) - 500.

Emergency drawdown line at maximum pool elevation - Not available.

Left spillway capacity (3) - 320.
Right spillway capacity (3) - 390.

Combined spillway capacity (3) - 710.

c. Elevation. (Feet above msl.)

Top of dam (design) - Unknown.

Top of dam (lowest elevation) - 1425.4.

Maximum pool - 1425.4.

Normal pool (spillway crest) - 1423.0.

Upstream invert outlet works - Not available.

(1) The drainage area was reported as being 1.3 square miles by the Owner and by the Pennsylvania Water Supply Commission in their 1918 report. PennDER used a value of 2.0 square miles in their 1962 report on the application of the Owner to modify the left spillway bridge. Gannett Fleming Corddry and Carpenter, Inc., checked the drainage area and used 2.0 square miles. Apparently, the drainage area was never updated by the Owner after the area was re-mapped by the USGS in 1955.

(2) Tropical Storm Agnes, June 1972. Based on information from the Owner, estimated with pool 0.5 foot below top of dam.

(3) Spillway discharges may be limited by downstream conditions, see Section 5.

c. Elevation (Cont'd.)

Downstream invert outlet works - (See text.)

Upstream invert water supply line - Not available.

Streambed near outlet works - 1380.0 (Approximate.)

d. Reservoir Length. (Miles.)

Normal pool - 0.60.

Maximum pool - 0.61.

e. Storage. (acre-feet.)

Normal pool - 921

Maximum pool - 1,091

f. Reservoir Surface. (Acres.)

Normal pool - 70.

Maximum pool - 72.

g. Dam.

Type - Zoned earthfill.

Length - 1,350 feet (embankment - approximate.)

Height - 45 feet.

Top Width - Varies 29 feet to 41 feet.

Side Slopes - Upstream - 1V on 2H. (Approximate). Downstream - 1V on 1.5H

Zoning - Clay core, dimensions not available.

Cutoff - None.

Grout Curtain - None.

h. Diversion and Regulating Tunnel. None.

i. Spillway.

Type - Right spillway - Broad crested masonry weir (width - 3.0 feet).

i. Spillway (Cont'd.)

Left spillway - Broad crested masonry weir (width - 2.0 feet).

Length of Weir - Right spillway - 38.9 feet.
Left spillway - 31.5 feet.

Crest Elevation - Right spillway - 1423.0
Left spillway - 1423.0

Upstream Channel - Right spillway - short approach from reservoir with vertical masonry approach wall, on left.
Left spillway - reservoir.

Downstream Channel - See Text.

j. Regulating Outlets.

Type - See Text.

Length - See Text.

Access - To downstream end and valve house only.

Regulating Facilities - Not available.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. Almost no engineering data was available for review for the original structures. Basic figures and descriptions were presented in a report in 1918 by the Pennsylvania Water Supply Commission from interviews with the Owner, visual inspection, and other sources. Plans for the 1962 re-building of the roadway bridge across the left spillway channel and subsequent inspections by the Commonwealth were available for review.

b. Design Features. Eisenhuth Dam consists of a zoned-earthfill embankment with a clay core, two spillways with masonry weirs, and two outlet works. The spillways are located at each abutment of the dam. One outlet works is located near the center of the embankment. The other is located near the left abutment. The locations of the various features are shown on Plate 2. A discussion on geology is presented in Appendix E.

The embankment is 1,350 feet long and 45 feet high at maximum section (Photographs A, B, and C). The embankment contains a clay core of unknown dimensions near the axis of the dam. The upstream and downstream zones consist of a mixture of clay and gravel. The reported design width of the top of the embankment is 42 feet. Geological investigations for the 1918 report indicate that the bedrock at the damsite is red shale and disintegrated conglomerate. Both the upstream and the downstream embankment slopes are covered with hand-placed riprap, and the top of the embankment is covered with gravel. The upstream slope is 1V on 2H, and the downstream slope is 1V on 1.5H. There is a drainage ditch, about 15 feet beyond the downstream toe that extends from near the left abutment to about 100 feet to the left of the valve house (Photograph L). The date and method of design and construction of the drainage ditch are unknown.

One spillway (left spillway) is located at the left abutment of the embankment. The masonry, free overfall spillway weir crest is about 1.2 feet above the downstream apron; the width of the weir is 3.0 feet; the crest length is 31.5 feet; and the crest is at Elevation 1423.0 (Photograph D). The channel downstream of the masonry weir is flanked by vertical, parallel masonry

training walls that are about 3.5 feet high and 2.0 feet thick. The left training wall is about 22 feet long, and the right training wall is about 56 feet long. Immediately downstream of the masonry weir, there is a concrete apron that is 31.5 feet wide and extends 6.3 feet downstream on a mild slope. The downstream end of the concrete apron drops vertically about 1.0 foot to a red shale that is the bottom of the spillway outlet channel. A concrete roadway bridge crosses the spillway channel. The upstream side of the bridge is 5.5 feet downstream of the masonry weir. The width of the bridge deck is 15.0 feet. The low chord of the bridge is at Elevation 1425.5. The low point of the bridge deck is at Elevation 1426.9. The bridge is supported by a 3.1-foot wide by 15-foot long rectangular pier in the spillway outlet channel. The centerline of the pier is 8.7 feet to the right of the left training wall. About 44 feet beyond the downstream side of the bridge, there is a concrete weir across the spillway outlet channel with a crest length of 27.6 feet, a width of 1 foot, and a depth of 4.1 feet (Photograph E). A rectangular notch, 8 feet long and 1 foot deep, is located near the center of the spillway outlet channel. The invert of the weir is at Elevation 1420.8. Flow from the left spillway outlet channel discharges into Mill Creek 0.2 mile downstream of the dam.

The other spillway (right spillway) is located at the right abutment of the embankment. The masonry spillway weir is 0.2 foot higher than the approach channel. The width of the weir is 3.0 feet; the crest length is 38.9 feet; and the crest is at Elevation 1423.0 (Photographs F and G). The channel downstream of the weir is flanked by a vertical dry masonry training wall on the left and by the natural slope of the hillside on the right. The left training wall is about 3.5 feet high, 2 feet thick, and 100 feet long. The left training wall is basically normal to the axis of the dam for about 70 feet, then it deflects right approximately 45 degrees and forms the headwall for two 18-inch diameter cast-iron pipes (CIP). These are shown on Plate 2. The two pipes pass under a roadway embankment that crosses the right spillway channel. This roadway embankment extends to the top of the dam. The natural slope of the right abutment hillside is about 1V on 2H. The hillside downstream of the spillway weir curves slightly to the left and ties into the headwall for the two pipes. Immediately downstream of the masonry weir, there is an 11-foot long masonry apron with a slope of about 1V on 3.7H. The upstream edge of the apron is 0.2 foot lower than the weir. The spillway outlet channel

downstream of the apron is about 30 feet wide, and its slope is about 1.3 percent (Photograph M). The headwall for the two 18-inch diameter CIP is located about 85 feet downstream of the weir (Photograph I). The left and right pipe inverts are at Elevations 1419.1 and 1419.2, respectively. The top of the headwall is at Elevation 1422.0. The pipes extend under the roadway embankment for a distance of about 64 feet and discharge at another headwall into an open channel. The pipe outlet inverts are approximately at Elevation 1417.0. Flow from the spillway outlet channel discharges into Mill Creek about 0.2 mile downstream from the dam.

One outlet works is located near the left abutment of the embankment about 100 feet upstream from the left spillway. This outlet works contains reservoir drawdown facilities. However, these facilities are abandoned. No information was available for the design, construction, or original capabilities of the drawdown facilities. The outlet structure is located on the left bank of the left spillway outlet channel, approximately 115 feet downstream of the spillway weir. Flow from the reservoir drawdown facilities, if they were operational, would discharge into the left spillway outlet channel.

The other outlet works, which contains the water supply facilities, is located near the center of the embankment. Intake structure conditions are unknown. A valve house is located at the downstream toe of the embankment. A 12-inch diameter CIP on the right and a 10-inch diameter CIP on the left extend downstream beyond the valve house. Information on the valves in the valve house is unknown. There is a manually operated gate valve in the left supply line about 34 feet below the valve house. There is a valve enclosed in a cast-iron casing in the right supply line about 24 feet below the valve house. The left supply line reduces to an 8-inch diameter below the valve, and terminates about 250 feet downstream of the embankment near the remains of an old pumphouse. The right supply line extends downstream and joins the Owner's water distribution system.

The caretaker of Eisenhuth Dam lives 0.25 mile upstream of the dam near the left shoreline of the reservoir. Access to the dam is by a 1.8-mile unpaved road from the east that leads to the bridge that crosses the left spillway channel. Access can also be obtained by a 1.1-mile unpaved road from the community of Morea Colliery to the north that leads to the roadway embankment that crosses the right spillway channel. There is an

access road from the right abutment to the outlet works at the downstream toe of the embankment.

2.2 Construction.

a. Data Available. Construction data available for review for the original structure was limited to information contained in the 1918 report prepared by the Pennsylvania Water Supply Commission. That information was obtained by interviews with the Owner, and it gives limited details of the construction. Limited details of the re-construction of the roadway bridge across the left spillway channel in 1962 are available.

b. Construction Considerations. Since the available construction data is limited, construction methods cannot be assessed. The 1918 Pennsylvania Water Supply Commission report stated that Eisenhuth Dam was solid and well built.

2.3 Operation. No formal records of operation were reviewed. The intake facility for the outlet works near the left abutment of the embankment had been damaged by ice some time ago. The valve at the intake structure is inoperable, and the reservoir drawdown facilities have been abandoned. The left water supply line had performed satisfactorily, but service from the left supply line to the community of Morea Colliery has been discontinued. The left water supply line and the associated appurtenant works have been abandoned.

2.4 Other Investigations. No known investigations other than those previously described were reviewed. The caretaker reported that consideration had been given to raising the embankment. He stated that an exploratory program had been instituted in 1932 and that the drill hole casings could be seen near the toe of the dam. He discarded the core samples in 1977. They were stored beneath his house. He believed that the Commonwealth had disapproved raising the embankment. No such records were available in the PennDER files reviewed.

2.5 Evaluation.

a. Availability. Engineering data was provided by the Division of Dams and Encroachments, Bureau of Water Quality Management, Department of

Environmental Resources, Commonwealth of Pennsylvania, and by the Owner, Schuylkill County Municipal Authority. The Owner made available the general manager and a caretaker for information during the visual inspection.

b. Adequacy. The type and amount of design data and other engineering data are very limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The general appearance of this project indicated that some project features have deteriorated with age and are in need of repair, while other project features have been properly maintained and are in good condition.

b. Embankment. The embankment is generally in good condition. Brush with an average height of about 2.5 feet was growing sparsely on the downstream slope of the embankment. Results of the survey of the downstream slope indicate that the slope varies from 1V on 1.6H to 1V on 1.8H. This is slightly flatter than the design slope of 1V on 1.5H. The riprap on the downstream slope bulges at several places around the lower portion of the embankment near the valve house. A typical bulge is 4 inches high, 3 feet wide, and 8 feet long. There is a line of utility poles supporting a single telephone line at the downstream toe across the entire length of the dam. Three drill hole casings with caps were observed at the downstream toe of the embankment. The caps could not be removed. There are large, mature trees immediately below the telephone poles extending from the valve house to the left spillway. The riprap on the upstream slope of the embankment is generally in place and is in good condition. Brush with an average height of about 2 feet is spread sparsely on the upstream slope above normal pool. The survey of the top of the dam revealed that the elevation along the top of dam was irregular. The lowest point on the top of dam is 2.4 feet above the spillway crest, while the highest point on the top of dam is 4.4 feet above the spillway crest. The survey also revealed that the width of the top of dam was irregular and varied from 29 feet to 41 feet, while the design width is 42 feet. There were a few pools of standing water on the top of dam.

There are three seepage areas at the downstream toe of the embankment. These areas are shown on Plate 2. Seepage Area No. 1 extends from 60 feet to 410 feet to the left of the valve house. This area is wet and spongy and extends about 200

feet downstream. Some of the flow from the first seepage area drains into the drainage ditch at the toe of the embankment and the remainder drains directly into the original Eisenhuth Run streambed. Flow in the drainage ditch is intermittent. At some points, the flow disappears beneath the surface. The drainage ditch empties into the original Eisenhuth Run streambed. The flow from Seepage Area No. 1 is clear, and the discharge is 30 to 40 gpm. Seepage Area No. 2 extends from 40 feet to 100 feet to the right of the valve house. This area is 10 feet wide and was probed to a depth of 1 foot. Flow from Seepage Area No. 2 drains into the ground through a few holes that were 1.5 inches in diameter. Flow from Seepage Area No. 2 is clear, and the discharge is about 0.5 gpm. Seepage Area No. 3 is about 30 feet downstream of the valve house. Water is flowing from under the right water supply line, where the line is above the surface of the ground. The flow starts about 6 feet downstream of the valve in the line and drains into the original Eisenhuth Run streambed. Flow from Seepage Area No. 3 is also clear, and the discharge is 3 to 5 gpm.

c. Appurtenant Structures.

(1) Left Spillway. The left spillway is in fair condition. The masonry weir is sound and intact. A 12-foot long section of the left masonry training wall was washed out. The portion missing is the downstream end, which originally extended beyond the bridge. The remaining portion of the wall is undermined 10 inches horizontally and 6 inches vertically. An area 3 feet by 3 feet by 3 feet deep is scoured out behind the area where the left wall was washed out. There is a longitudinal crack in the mortar joint 20 inches below the top of the right masonry training wall. The crack extends the entire length of the wall and is 1/4 inch wide. No evidence of differential movement at the crack in the right wall was observed. The concrete apron immediately downstream of the masonry weir is undermined at the downstream end. The apron is undermined for a length of 15 feet, a distance of 1.5 feet horizontally, and a distance of 8 inches vertically. A very small amount of clear water is flowing under the apron. The water runs into a 10-foot by 5-foot by 4-inch deep pool at the bridge pier. The channel immediately downstream of the bridge is covered with very dense weeds and brush. The average height of the weeds and brush is about 3 feet.

Three tension cracks were observed on the bottom surface of the bridge deck. The cracks extend normal to flow in the channel and were 1/8 inch wide and 1/4 inch deep. No evidence of differential movement at any crack in the bridge deck was observed. The prestressed beams supporting the bridge deck are successively offset about 3/8 inch. The top of the concrete weir that is 44 feet downstream of the bridge was spalled to a depth of 1 inch over a 28-inch by 12-inch area. Coarse aggregate was exposed on the downstream face of the weir directly below the notch in the weir.

(2) Right Spillway. The right spillway is in good condition. The masonry weir has had several small sections capped with concrete. There was minor brush growth through the apron below the weir. Fifty percent of the channel immediately downstream of the apron was covered with 2.5-foot high brush. A tree, 8 inches in diameter and 35 feet high, as well as several small trees up to 2 inches in diameter and 12 feet in height, were observed in the channel.

(3) Outlet Works at Left Abutment. The Owner reported that the intake structure for the outlet works at the left abutment had been damaged by ice many years ago. The valve at the intake structure was reported to be inoperable. The stem is severely bent. The outlet for the blowoff line was not observed. The Owner reports that this outlet works has been abandoned.

(4) Outlet Works Near Middle of Embankment. The intake facilities for this outlet works were submerged. The condition and nature of the intake facilities are unknown since the reservoir water level was near normal pool and no data was available for the design or construction of the intake facilities. The valve house was locked. The key to the lock on the door turned, but failed to open the lock. Rust was observed on the padlock shaft. The interior of the valve house was not observed. However, any valve on the right line, the 12-inch diameter CIP, must be at least partially open since the right line is the active water supply line from the dam. Apparently, water supply regulation is obtained by operating the valve about 24 feet downstream of the valve house. At least one valve on the left water supply line, the 10-inch diameter pipe, must be closed since there is an open end at the terminus of

the line about 250 feet downstream of the dam. The Owner reported that the left water supply line and the appurtenant works for the line have been abandoned. Since the right line is an active water supply line and the left line terminates without provision for being a blowoff, no valves were operated.

d. Reservoir Area. The reservoir slopes are covered with scrub oak and other vegetation. No evidence of creep, rockslides, or landslides was visible. The Owner indicated that sedimentation is not a problem from the standpoint of reduced reservoir capacity. The watershed is primarily owned and controlled by the Schuylkill County Municipal Authority and is predominantly undeveloped. The construction of Interstate Route No. 81 required the acquisition of 13 acres of watershed land by the Pennsylvania Department of Transportation.

e. Downstream Channel. The left spillway outlet channel is trapezoidal in shape and moderate in slope. The channel bottom is a red shale. The side slopes are cut through both earth and rock with approximately a 1V on 1H slope. On the day of the inspection, there was no flow in the left spillway outlet channel.

The right spillway outlet channel below the roadway embankment has a steep bed slope that was excavated to rock for some distance below the culverts. Further downstream, it appears that the discharge has been permitted to erode its own channel. About 50 feet downstream of the roadway embankment, flow in the right spillway outlet channel has cut a relief channel that re-joins the right spillway outlet channel about 40 feet further downstream. About 40 feet below the point where the relief channel re-joins the outlet channel, there is an area of erosion that is 8 feet wide, 3 feet deep, and 15 feet long. At this point, channel overflows have scoured the channel bank as they emptied back into the right spillway outlet channel. On the day of the inspection, there was no flow in the right spillway outlet channel.

The channel below the valve house is the natural channel of Eisenhuth Run. The bottom of the channel is covered with small, loose rock, and the channel slope is mild. Flow in the outlet works channel was the total discharge from Seepage Area Nos. 1 and 3, as reported in Paragraph 3.1b.

f. Access Roads to Dam and Outlet Works. The condition of the access roads to the damsite was good. Access by vehicle to the outlet works near the middle of the embankment would be hampered by Seepage Area No. 2, reported in Paragraph 3.1b.

3.2 Evaluation.

a. Embankment.

(1) The continued growth of trees and brush on the embankment slopes and along the toe of the embankment is undesirable. Assessment of seepage is made difficult by growth near the toe of the embankment.

(2) The settling and resulting irregular elevation and varying crest width of the top of the embankment is of general concern, since the spillway capacity is reduced by the lower available head before overtopping. Flow over the low spots could quickly erode the earth embankment. Settlement is probably the cause of the irregular elevations. It is not known why the top width is narrower than previously reported. It may be that the previous measurements were in error, as no evidence of sliding or severe erosion was observed.

(3) The bulging of the riprap on the downstream slope of the embankment is of some concern. Bulges were initially reported in the same general area in the 1933 inspection report by the Commission. It is unknown if the number or size of the bulges have increased in recent years. The downstream slope being slightly flatter than the design slope is probably the result of not constructing to design template.

(4) Augering for telephone poles at the toe of the embankment is not a good construction practice. It could increase seepage.

(5) The pools of water on the top of dam indicate that the surface is not sloped to drain. They also indicate that the core in the embankment is impervious.

(6) The seepage areas at the downstream toe of the embankment have been reported in numerous inspection reports by the Commonwealth since 1924. The seepage areas have apparently stabilized, but because of the potential seriousness of the problem, the seepage areas are of concern.

b. Appurtenant Structures.

(1) Left Spillway. There is some concern for the condition of the left masonry training wall and the concrete apron downstream of the masonry weir. Lack of repair and maintenance may increase the deterioration and undermining of the wall and apron and thereby threaten the stability of the wall and apron. Continued deterioration and undermining could lead to a failure of the wall or apron, which may reduce the spillway capacity and threaten the stability of the masonry spillway weir. There is slight concern for the condition of the right masonry training wall. Additional cracking of the mortar joints or movement of the wall could become more of a concern in the future. The continued growth of brush and weeds in the left spillway channel is undesirable. The growth may reduce the capacity of the left spillway channel. There is slight concern for the condition of the bridge across the spillway channel. It is thought that the offsets observed were caused by uneven leveling during construction. The tension cracking could be an indication of excessive loads on the bridge. There is minor concern for the condition of the concrete weir downstream of the bridge. In its current state, the concrete weir may reduce discharges in the channel. A failure of the concrete weir would not present a significant hazard to the dam. This weir appears to serve no useful purpose at present.

(2) Right Spillway. The continued growth of brush and trees in the right spillway channel is undesirable. The growth may reduce the capacity of the right spillway channel.

(3) Outlet Works at Left Abutement. There is general concern for the reservoir drawdown facilities. At the present time, the only method of draining the reservoir is by means of the right water supply line. Furthermore, since the intake structure at the left abutment has been damaged by ice, it is unknown if the conduit that leads to the blowoff facilities in the left spillway outlet channel is under full hydrostatic pressure. It is undesirable to have a conduit through the embankment without having means of closing the conduit on the upstream side of the embankment.

(4) Outlet Works Near Center of Embankment. It appears that the valve house door has not been opened recently. At least one pipe under pressure extends upstream from the valve house beneath the embankment. There does not appear to be upstream closure facilities for any pipe. There are no operational emergency drawdown facilities.

c. Reservoir Area. No conditions were observed in the reservoir area that might present a significant hazard to the dam.

d. Downstream Channel. No conditions were observed in the downstream channel below the left spillway that might present a significant hazard to the dam. There is some concern for the downstream channel below the right spillway. Since this condition affects the hydraulics, it is evaluated further in Section 5. No conditions were observed in the downstream channel below the valve house that might present a significant hazard to the dam. Additional discussion on downstream conditions is presented in Paragraph 5.1e.

e. Access Roads to Dam and Outlet Works. No conditions were observed that might prevent access to the dam or to the outlet works.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at spillway crest Elevation 1423.0 with excess inflow discharging over the spillways. A 12-inch diameter CIP draws water from an unknown elevation in the reservoir. Some regulating facilities for the water supply line are provided in the valve house at the downstream toe of the dam. Additional regulating facilities are provided just downstream of the valve house. The water supply line extends 3.6 miles to a treatment plant near the small community of Dark Water. Between the dam and the treatment plant, water supply lines from other dams in the Owner's system join the water supply line from Eisenhuth Dam. At the treatment plant, the water enters the distribution system. Other lines at Eisenhuth Dam are presently considered abandoned by the Owner.

4.2 Maintenance of Dam. The caretaker for Eisenhuth Dam lives adjacent to the dam, about 0.2 mile upstream along the reservoir. He is responsible for the security of the site, for taking weekly readings of pool elevation, and for taking readings, when warranted, on a nonrecording rain gage located near his residence. The data is delivered to a central facility, where it is recorded and used to evaluate the storage remaining in and the capabilities of the Owner's system. Regulation of the valve on the water supply line is by a valve crew dispatched from the Owner's main office. To the best of the caretaker's recollection, the valves had not been operated for 2 years. Penn East Corporation, an engineering consultant to the Owner, makes an inspection of the Schuylkill County Municipal Authority system each year. Reports are sent to the Owner and are kept on file. The Owner apparently does not require a detailed inspection of the physical condition of the dam, as the annual reports place emphasis on the Authority's operations. Informal inspections are made by the caretaker during his visits to the damsite. These visits are mostly to obtain data for operating conditions and to check for trespassers.

4.3 Maintenance of Operating Facilities. There is apparently no regular maintenance program for any of the operating facilities, some of which are considered abandoned by the Owner.

4.4 Warning Systems in Effect. The Owner gave the inspection team a verbal description of the emergency warning and operation system that is applicable for all Schuylkill County Municipal Authority dams. The Owner said that, during periods of heavy rainfall, available personnel are dispatched to the dams to observe conditions round-the-clock. All company vehicles are equipped with radios, and the personnel can communicate with a central facility. Evaluation of risk is made by the general manager. He is also responsible for notification of emergency conditions to the Schuylkill/Pottsville Office of Civil Defense, which, in turn, would notify local authorities. The Office of Civil Defense does not have a detailed emergency warning plan for the Owner's dams, but it does have a detailed emergency warning plan for severe weather conditions and similar events. Detailed emergency operational procedures have not been formally established for Eisenhuth Dam, but are as directed by the Owner's general manager.

4.5 Evaluation. The amount of brush observed on the downstream slope indicates that a more frequent brush-cutting schedule is warranted. The procedures used by the Owner to inspect the dam need improvement. During the annual inspection, there is insufficient emphasis placed on the physical condition of the dam. Also, insufficient emphasis is placed on the physical condition of the dam during the visits by the caretaker. Since the emergency drawdown facilities are considered abandoned by the Owner, no maintenance is performed on these lines. The emergency operational procedures are too informal and not in sufficient detail. The emergency warning system is good, but the assessment of conditions that would require activation of the emergency warning system could be improved. The chain of command is too informal, not in sufficient detail, and poorly defined in the General Manager's absence.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data.

(1) No hydrologic or hydraulic analyses for the original Eisenhuth Dam design were available for review. The spillway capacity has been estimated in past years by the Commonwealth both for their 1918 report on the dam and their report on the application of the Owner to modify the bridge at the left spillway. Spillway capacity as used in this Section refers to the combined capacity of the right and left spillways.

(2) In the recommended guidelines for safety inspection of dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended spillway design flood for the size (intermediate) and hazard potential (high) classification of Eisenhuth Dam is the Probable Maximum Flood (PMF). If the dam and spillway are not capable of passing the PMF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

(3) The 1918 report by the Pennsylvania Water Supply Commission estimated the spillway capacity of Eisenhuth Dam at 1,900 cfs with 4.0 feet of head on the spillways and 1.0 foot of freeboard.

The crest lengths of the right and left spillway were reported as being 40 and 50 feet, respectively. In the 1962 report upon the application of the Owner to modify the left spillway bridge, the capacity of the left spillway was estimated at 1,470 cfs. This was computed using 5.08 feet of head and a weir crest length of 44.5 feet. In the 1962 report, the right spillway capacity was reported as 1,470 cfs. The existing geometry is complicated and somewhat in variance with the figures above. Dimensions and elevations obtained in the field for this report indicate that the spillway weirs are shorter than previously reported and the available head is less. This results in a substantial decrease from the previously reported spillway capacity. For this study, calculations were performed to estimate the capacity of each spillway using assumptions which simplify the calculations and using dimensions obtained in the field for this report (Appendix C). As described hereinafter, the channels downstream of the spillways will have an effect on spillway capacity. The calculations required to quantitatively determine the effect is beyond the scope of this report. The spillway discharge capacity of 710 cfs estimated for this report has not been reduced to account for downstream conditions.

(4) The right spillway weir is about level with the approach channel invert. A masonry apron extends downstream of the weir for about 10 feet. The channel downstream of the apron extends for about 75 feet to a headwall. This headwall is actually an extension of the wall to the left of the spillway weir. Two 18-inch diameter pipes extend from the headwall, under a roadway fill, to another headwall. Below the second headwall, spillway discharges follow an existing stream. The upstream headwall has an approximate top elevation of 1422.0. Details are shown on Plate 2. The two 18-inch diameter pipes are obviously incapable of passing the right spillway discharge without a greater head than is available. Headwater at these pipes would overtop the roadway fill and flow over the road. The Owner reported flow over the roadway during Tropical Storm Agnes in June 1972. As the length of the overflow area is approximately equal to the right spillway weir length, a backwater condition would probably be created on the weir, thereby reducing its capacity. Furthermore, there may be a possibility that flows over the road would extend

along the toe of the dam, creating an erosion hazard. From the visual inspection, it was impossible to estimate a flow path if the right spillway was discharging at full capacity. It appeared that most of the water would flow away from the toe. The roadway fill near this spillway was first noted in 1962 during one of the periodic inspections by the Commonwealth. The Commonwealth ordered the fill removed in June 1962. After another inspection, it again ordered it removed in April 1971. A letter from the Owner to the Commonwealth in May 1971 assured that the fill would be removed within a month.

(5) The left spillway is a masonry weir with about a 17.5-foot long area on the left available for overbank flow. However, the low chord of the spillway bridge, which is 5.5 feet downstream of the weir, would only allow a maximum depth of flow of 2.0 feet in the overbank. The low chord of the bridge is at approximate top of dam elevation. There is a pier in the center of the bridge. Downstream of the bridge, the spillway channel is an overgrown earthen channel with a wall on the right. Forty-four (44) feet downstream of the bridge, there is a concrete weir, once used to measure flows. Hydraulic control in this spillway could either be at the spillway weir, under the bridge, or at the weir downstream. Should debris collect on the low chord of the bridge, pressure flow at the bridge could be a control. Even if the structures in the spillway channel are not a control, they could produce a backwater effect, thereby reducing the discharge capacity. The condition is complex and a quantitative analysis is beyond the scope of this report.

(6) Schuylkill County Municipal Authority owns and posts all of Eisenhuth Dam watershed. Most of the watershed remains undeveloped. Hydrologic analysis for this study was based on existing conditions, and the effects of future development of the watershed were not considered.

b. Experience Data. For this study, the PMF was obtained from the curve of PMF peak flow versus drainage area for this region of the Delaware River Basin(1). The numerical value of the peak runoff is

(1) Obtained from the Baltimore District, Corps of Engineers.

1,700 cfs per square mile. The PMF peak flow was estimated to be 3,350 cfs. The volume of the inflow hydrograph was adjusted so that it represented 24 inches of runoff from the entire watershed. The maximum known flood at the damsite is estimated at 500 cfs during Tropical Storm Agnes, June 1972. Based on information from the Owner, the discharge was computed assuming the pool was 0.5 foot below top of dam.

c. Visual Observations. During the inspection of Eisenhuth Dam, it was observed that the channels downstream of the spillways were overgrown. This vegetation could cause backwater to reduce the spillway discharge capacity. Other observations are presented in Paragraphs 5.1a.(4) and 5.1a.(5).

d. Overtopping Potential. For an occurrence of the PMF, the peak inflow of 3,350 cfs is greater than the spillway capacity of Eisenhuth Dam. A check of the surcharge storage effect of Eisenhuth Reservoir shows that the surcharge available is insufficient to contain an inflow with a peak flow of 3,350 cfs without overtopping the dam (Appendix C).

e. Downstream Conditions. Eisenhuth Dam is 3.8 miles northeast of St. Clair, Pennsylvania, as shown on Plate 1. Flows from Eisenhuth Dam proceed downstream along Eisenhuth Run about 0.2 mile to its confluence with Mill Creek. Mill Creek proceeds downstream 2.0 miles to its confluence with Mud Run and to its confluence with Tar Run 0.2 miles beyond. Mill Creek then flows 1.3 miles to its confluence with Wolf Creek and then flows 1.3 miles to St. Clair, Pennsylvania. Mill Creek in some of the above reaches generally parallels Pennsylvania Route No. 61 and crosses under the road and also under railroad tracks a number of times. The road and railroad crossings for Mill Creek are either bridges or culverts under low embankments, neither of which would provide significant mitigating effects to floodflows.

Mill Creek flows for 0.8 mile through the center of St. Clair, which has homes directly adjacent to the low riverbanks. The creek then flows 1.4 miles along the edge of a railroad yard, and then flows for 0.6 stream mile through Port Carbon, Pennsylvania, to its confluence with the Schuylkill River. Port Carbon has homes directly adjacent to the low riverbanks. Downstream conditions indicate that a high hazard classification is warranted for Eisenhuth Dam.

f. Spillway Adequacy.

(1) The existing spillway will not pass the PMF without overtopping the dam. One-half of the PMF inflow is 1,675 cfs and is greater than the spillway capacity. A check of the surcharge storage effect of Eisenhuth Reservoir shows that the surcharge storage available is insufficient to contain an inflow with a peak flow of 1,675 cfs without overtopping the dam (Appendix C).

(2) The maximum tailwater is estimated to be Elevation 1383.4 at the spillway capacity of 710 cfs. At maximum pool elevation, there is a difference of about 42 feet between headwater and tailwater. If the dam would be overtopped, it would fail due to embankment erosion. If Eisenhuth Dam should fail due to overtopping, the hazard to loss of life downstream from the dam will be significantly increased from that which would exist just prior to overtopping.

(3) Based on established OCE criteria as outlined in Paragraph 5.1a.(2), the existing spillway capacity of Eisenhuth Dam is rated as seriously inadequate. Considering the existing low areas at top of embankment and considering the effects of the surcharge storage of 170 acre-feet, the spillway capacity of 710 cfs can accommodate a flood with a peak flow of 940 cfs for a storm of the same duration as the PMF. This is 28 percent of the PMF peak inflow.

(4) The design top of embankment elevation of Eisenhuth Dam could not be determined. The top of the right spillway wall is at Elevation 1425.4, which is also the lowest elevation along the top of the embankment. The top of dam elevation could not be raised without modification to this wall.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Eisenhuth Dam resulted in a number of observations relevant to structural stability. These observations are listed herein for the various features.

(2) Embankment. Three seepage areas were observed at or near the toe of the embankment. Bulges near the downstream toe were noted on the embankment slope. The detailed description and evaluation of these conditions are in Paragraph 3.1b.(4) and Paragraph 3.2a.(4), respectively.

b. Design and Construction Data. No records of design data or stability computations were available for review. Furthermore, except for exterior lines and grades and a reported clay core, almost nothing is known about the design or construction of the embankment. The available information shows that the upstream slope is about 1V on 2H and that the design downstream slope is about 1V on 1.5H. The downstream slope was found to be about 1V on 1.6H, as determined by surveys made during this inspection. Slopes of these grades, and particularly the downstream slope, are considerably steeper than present standard practice would allow. Consequently, it is not believed that the embankment has a large margin of safety.

The spillway weirs are sufficiently low that they are judged to be stable for the anticipated maximum loading conditions. Stability analyses are not usually performed on structures this small.

c. Operating Records. There is no evidence that any stability problems, except for bulging of the embankment, have occurred for the dam during its operational history of 103 years. However, it should be recognized that conditions could change, particularly with respect to seepage, that might significantly affect the future performance of the dam.

d. Post-Construction Changes. There have been no known modifications to Eisenhuth Dam that would affect the stability of the structure.

e. Seismic Stability. Eisenhuth Dam is located in Seismic Zone 1. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. However, the theoretical static stability of Eisenhuth Dam is not known.

SECTION 7

ASSESSMENT, RECOMMENDATIONS,
AND REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on the visual inspection, available records, calculations, and past operational performance, Eisenhuth Dam is judged to be in fair condition. Deficiencies of varying degree of importance were noted. A summary of the features and deficiencies is listed below:

Features and Location	Observed Deficiencies
Embankment:	
Top of dam	Low areas and varying width.
Downstream slope	Brush growth and bulging riprap.
Toe of dam	Telephone poles, trees too close, and seepage areas.
Earthfill	Pipes under pressure through embankment and steep slopes.
Left Spillway:	
Left masonry training wall	End washed out, undermining, and scour.
Right masonry training wall	Crack in masonry joint.
Concrete apron	Undermining.
Spillway channel	Brush and weeds.
Bridge	Cracks in underside.
Right Spillway:	
Spillway channel	Brush and trees.

Feature and Location	Observed Deficiencies
Outlet Works at Left Abutment:	
Intake structure	Damaged; outlet works inoperable.
Outlet Works Near Center of Embankment:	
Valve house door	Lock inoperable and no blowoff facilities.
Downstream Channel:	
Right spillway channel	Erosion hazard.

(2) The overtopping potential analysis shows that Eisenhuth Dam, as existing, will be overtopped by the PMF and by one-half of the PMF. Overtopping of the embankment would cause erosion failure. Therefore, based on OCE criteria, as outlined in Paragraph 5.1a.(2), the existing spillway capacity is rated as seriously inadequate. With the embankment at its existing elevation the existing spillways can accommodate a flood with a peak inflow of 28 percent of the PMF peak inflow. The bridge across the left spillway channel, the concrete weir in the left spillway channel downstream of the bridge, and the roadway embankment across the right spillway channel may affect the discharge capacity of the spillways.

(3) Because of the low heights of the spillway weirs, no analyses were performed to calculate the stabilities. It was judged that the spillway weirs should be stable.

(4) The combination of steep embankment slopes, particularly the downstream slope, and seepage are such that it is believed that the embankment stability factor of safety is close to unity. A change in conditions from those observed during this inspection could adversely affect the stability of the embankment.

b. Adequacy of Information. The information available is such that an assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately or in a timely manner, as noted.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations will be required.

7.2 Recommendations and Remedial Measures.

a. In view of the concern for safety of Eisenhuth Dam, the following measures are recommended, in approximate order of priority, to be undertaken by the Owner immediately:

(1) Remove the brush from the spillway channels.

(2) Remove the roadway fill and culverts in the right spillway channel and provide an adequate watercourse.

(3) Perform additional studies to more accurately ascertain the spillway capacity required for Eisenhuth Dam, as well as the nature and extent of the mitigation measures required to make both the spillways and the channels downstream of the spillways hydraulically adequate. These studies should also address any erosion potential caused by spillway discharge.

(4) Install two or more inclinometers in the downstream slope of the embankment near the maximum section to monitor any slope movement.

(5) Clear the area along the downstream toe of the embankment and identify all seepage outlets. Construct a system of channels and weirs so that flow measurements can be made for all seepage points and so that any accumulation of soils that might be coming from the embankment can be recognized. Monitor and record data so that any change in conditions is readily apparent.

(6) Perform surveys to more accurately determine the existing embankment template.

(7) Undertake an embankment and foundation exploration program to ascertain the engineering properties of the materials and perform a study to

determine the factor of safety for stability of the embankment. Take any remedial action that might be found necessary to ensure stability of the embankment.

(8) Provide upstream closure facilities for all pipes that are under pressure beneath the embankment.

(9) Provide erosion protection in the left spillway outlet channel.

(10) Perform a study to determine the emergency drawdown requirements of Eisenhuth Dam, as well as the nature and extent of the mitigation measures required to provide emergency drawdown capabilities.

(11) Undertake a program of detailed annual inspections of Eisenhuth Dam and utilize the results to determine if remedial measures are required.

(12) Develop a detailed emergency operation and warning system for Eisenhuth Dam.

b. In order to correct operational, maintenance, and repair deficiencies, and to more accurately determine the condition of the dam, the following measures are recommended to be undertaken by the Owner in a timely manner:

(1) Remove brush and trees on or near the downstream embankment slope.

(2) Repair or replace the lock at the valve house.

(3) Monitor cracking at the left spillway bridge and at the left spillway right training wall. If changes are noted, take appropriate action.

c. In addition, the following operational measures are recommended to be undertaken by the Owner:

(1) Provide round-the-clock surveillance of Eisenhuth Dam during periods of unusually heavy rains. Until remedial work that makes the spillways hydraulically adequate is complete, provide crews to remove any debris that may collect at the spillways during periods of high runoff.

(2) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

(3) Ensure that any future utility work, such as placing of poles, is a sufficient distance from the embankment.

DELAWARE RIVER BASIN

EISENHUTH RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

EISENHUTH DAM

NDS ID No. PA-00662
DER ID No. 54-55

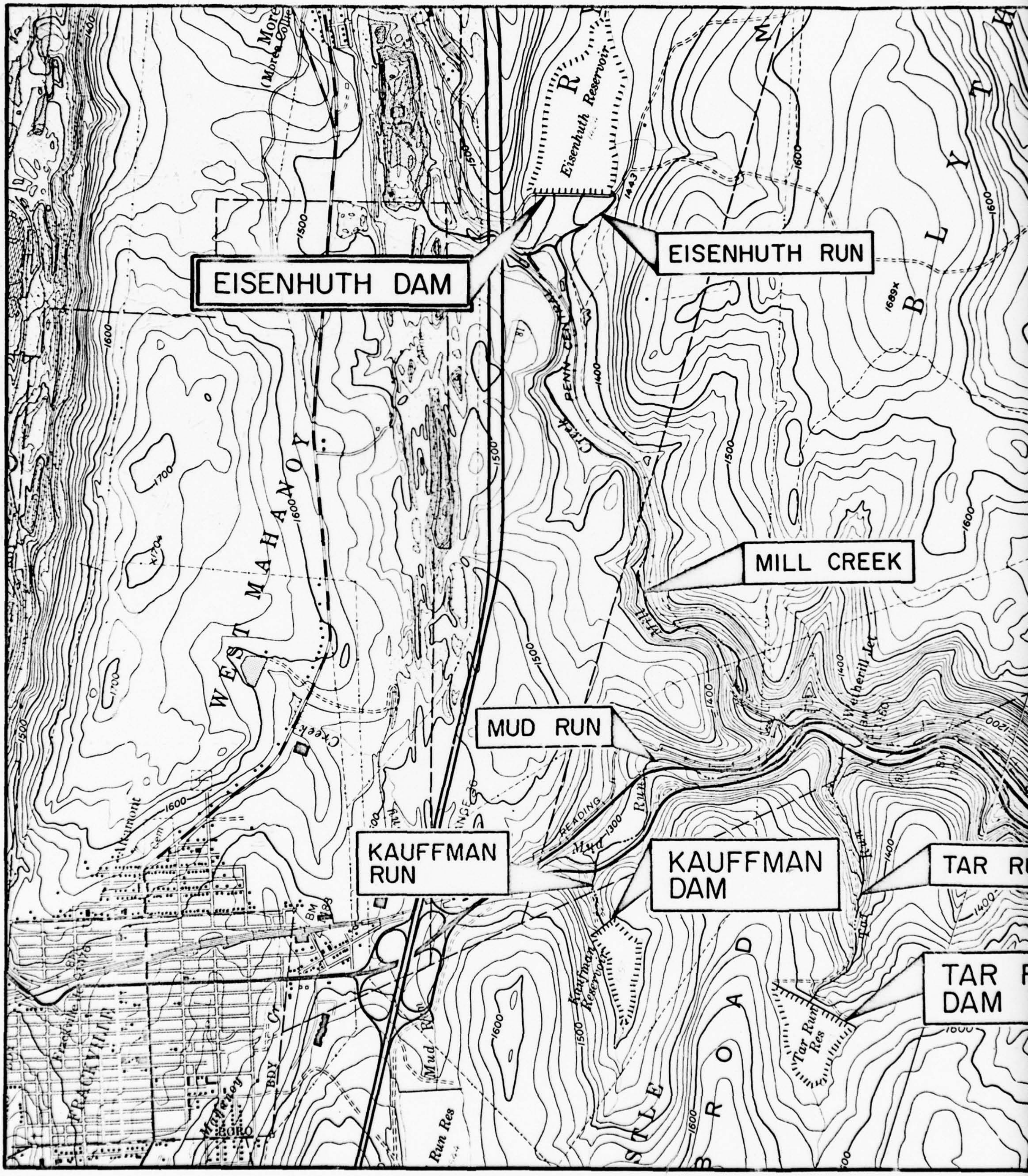
SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

PLATES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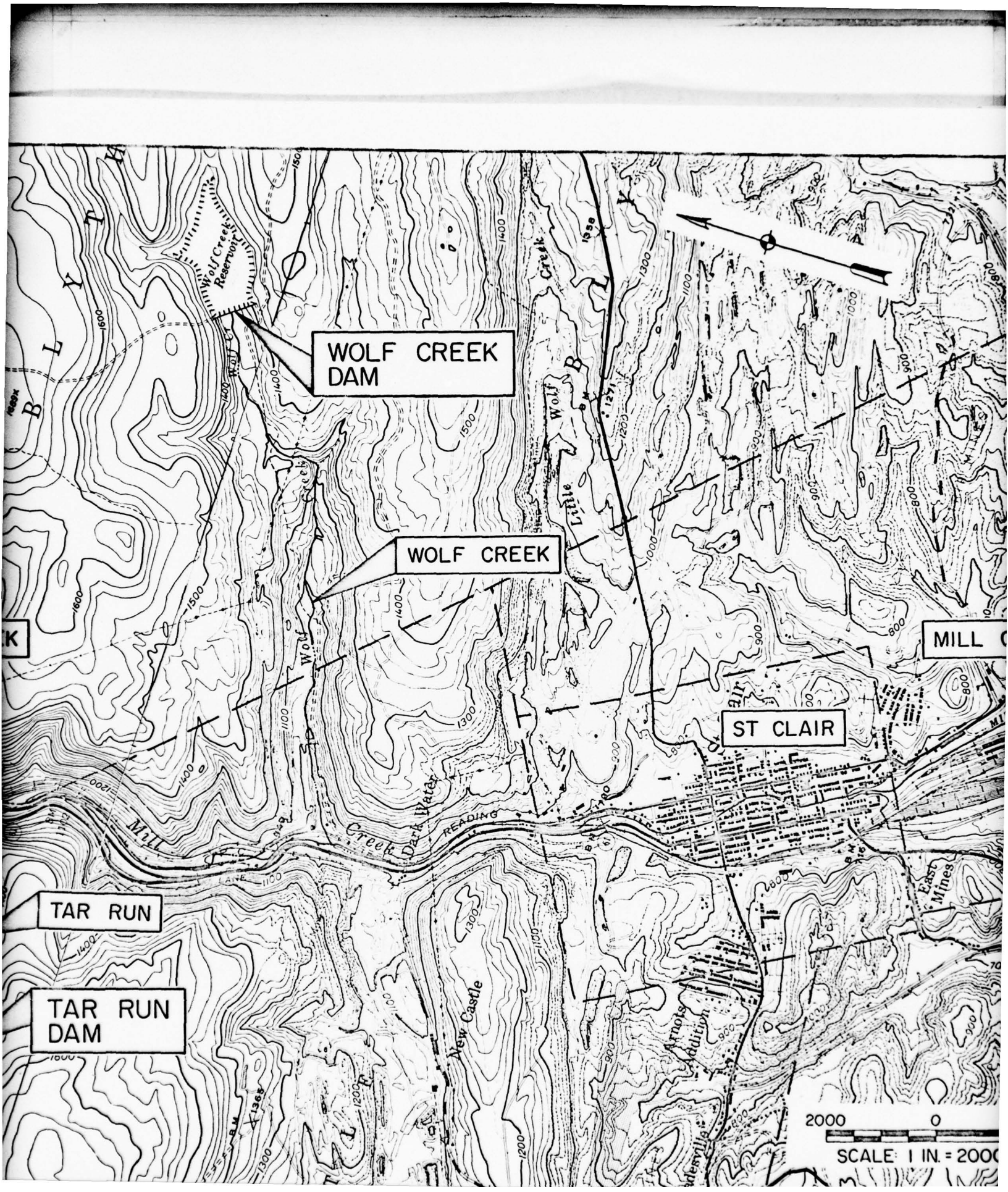
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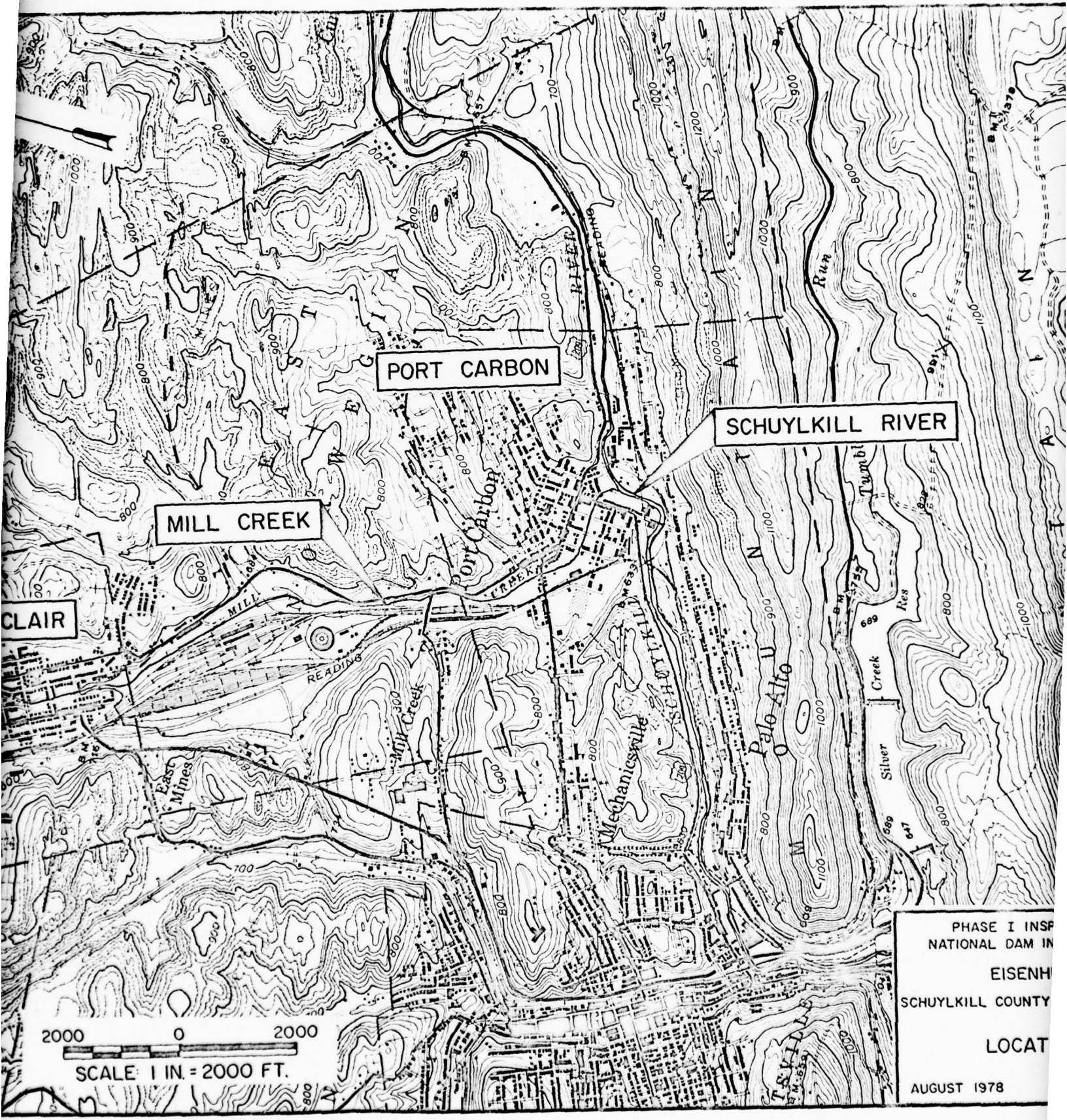
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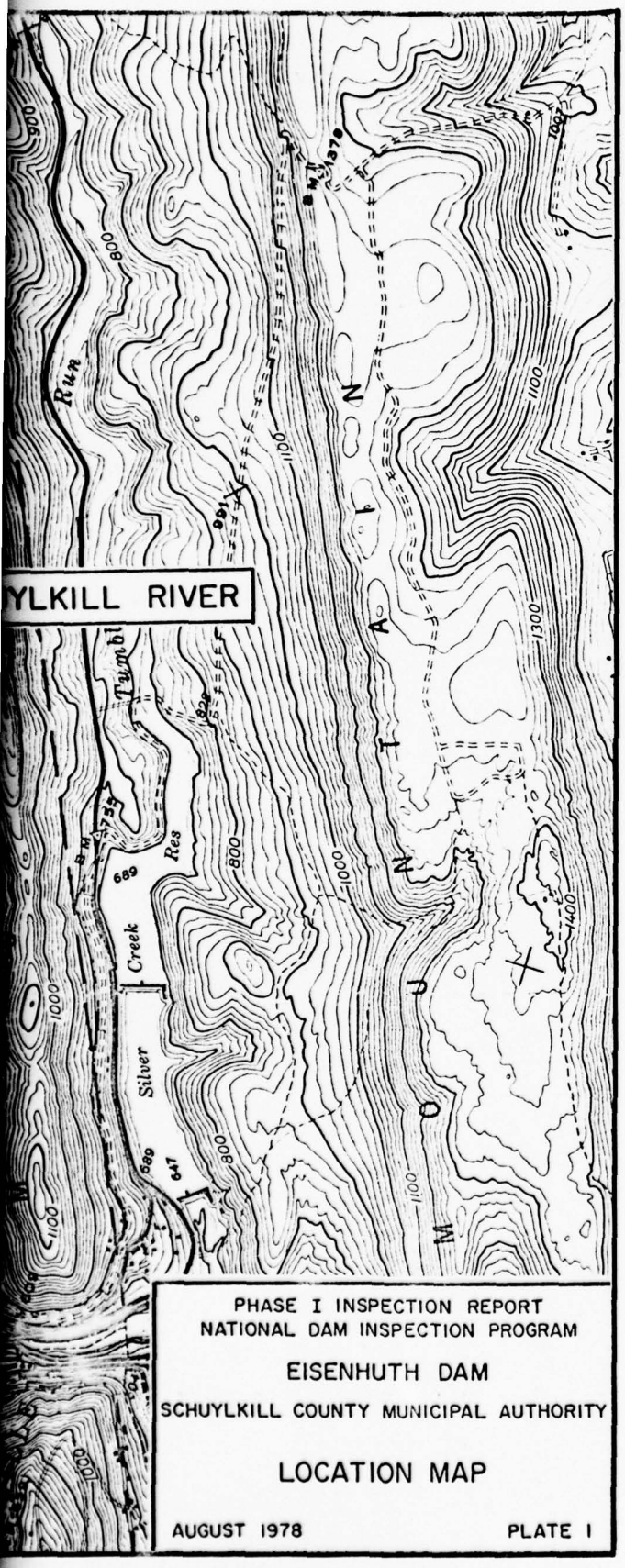

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

EISENHUTH DAM

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

LOCATION MAP

AUGUST 1978 PLATE 1

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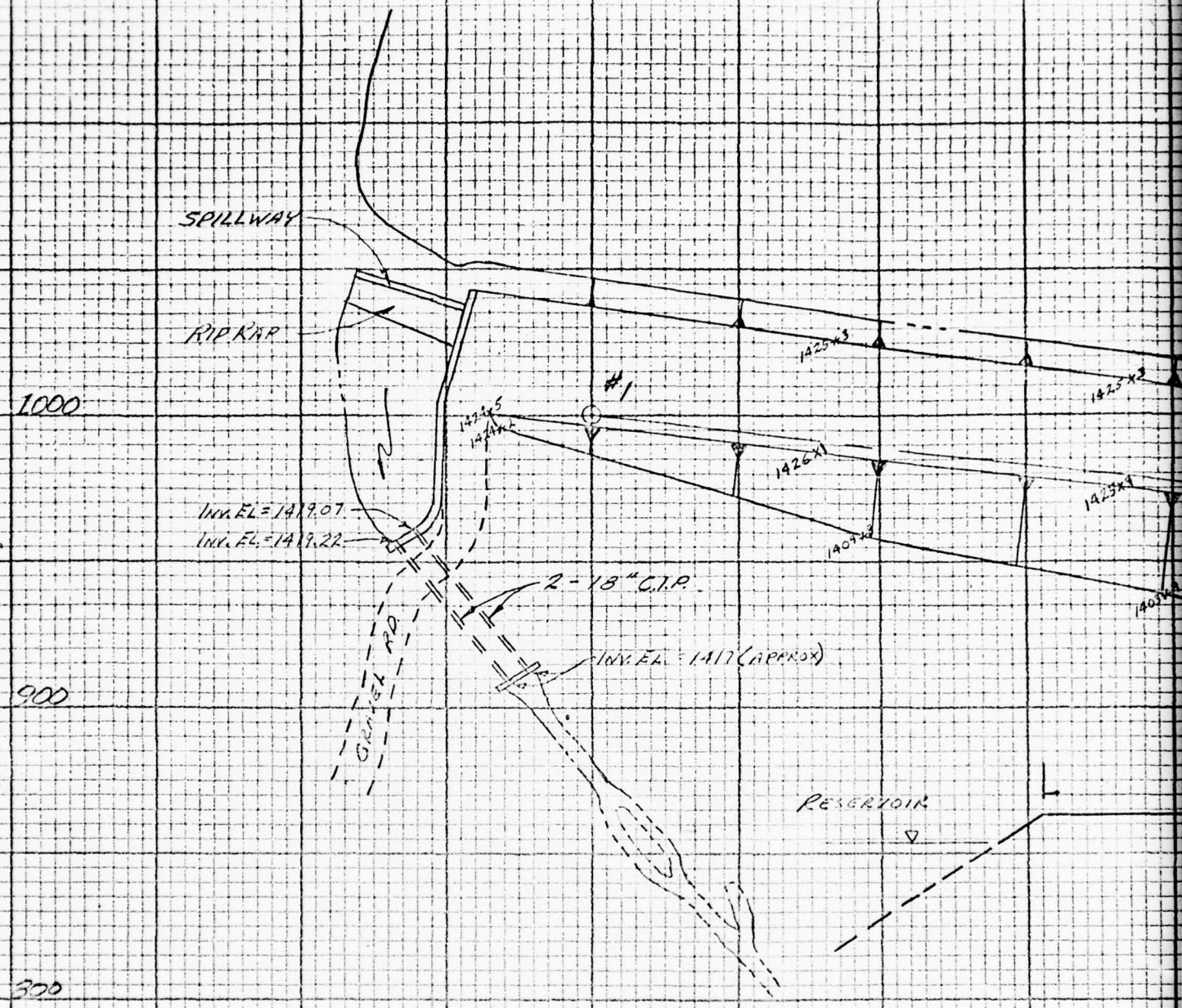

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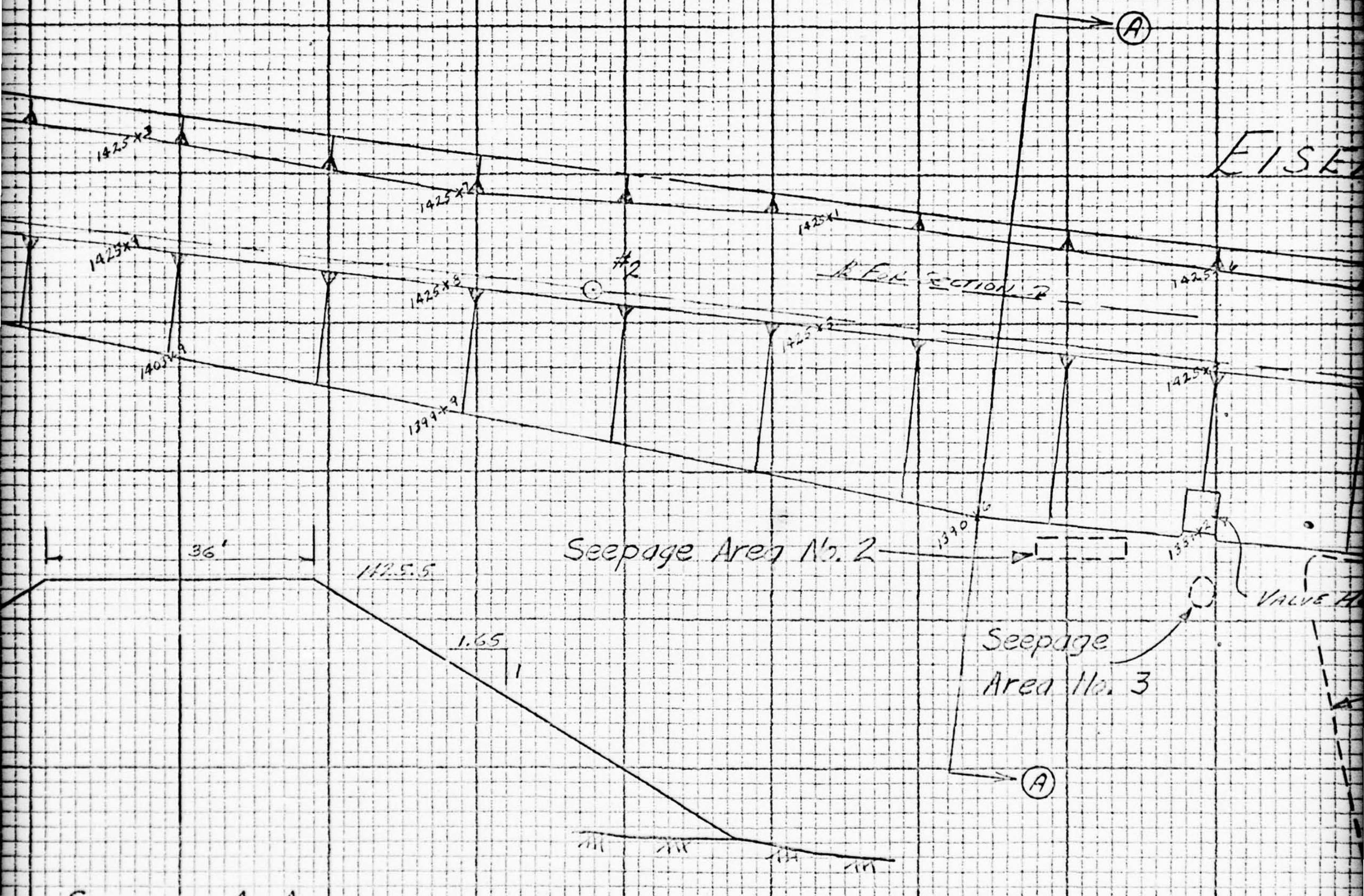

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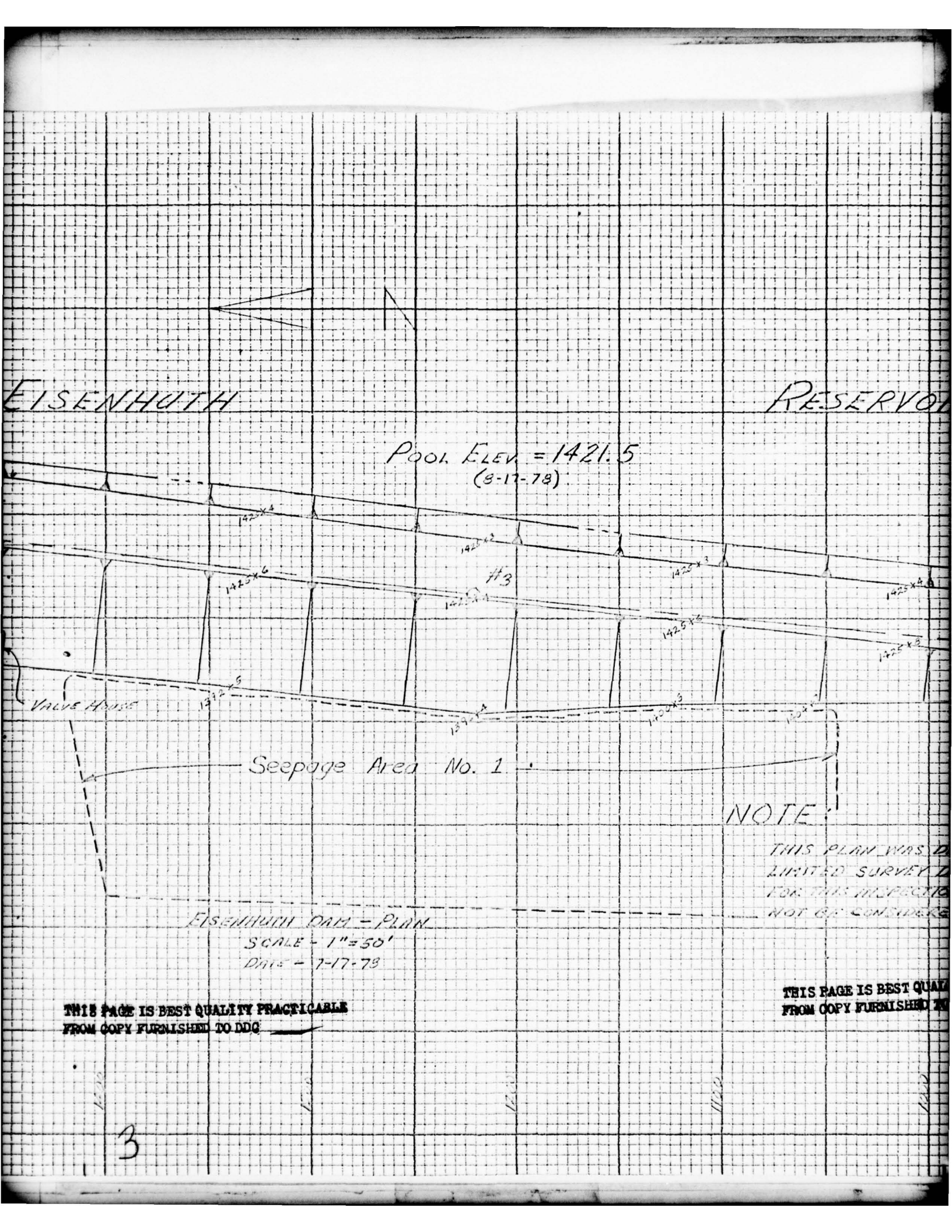

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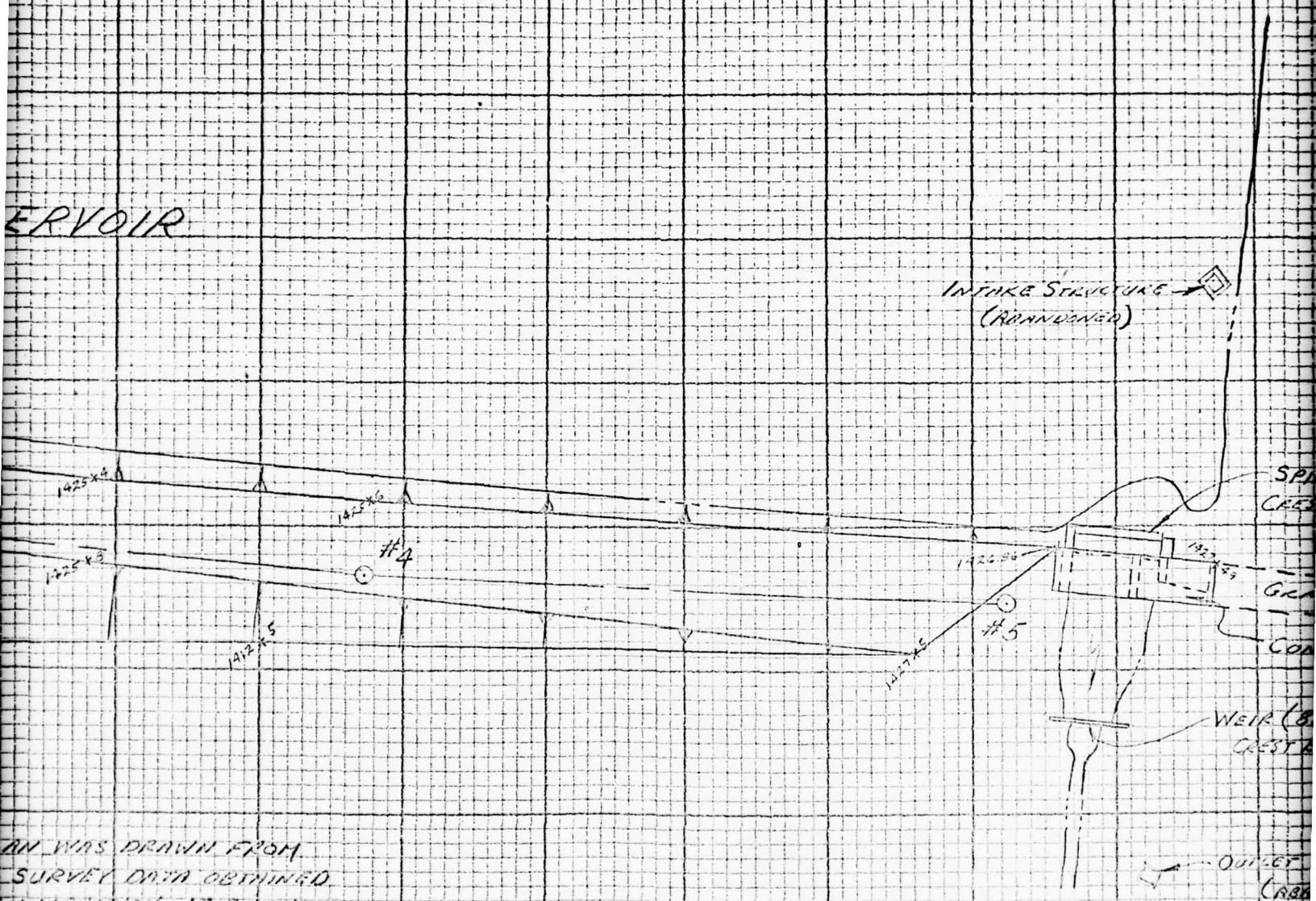

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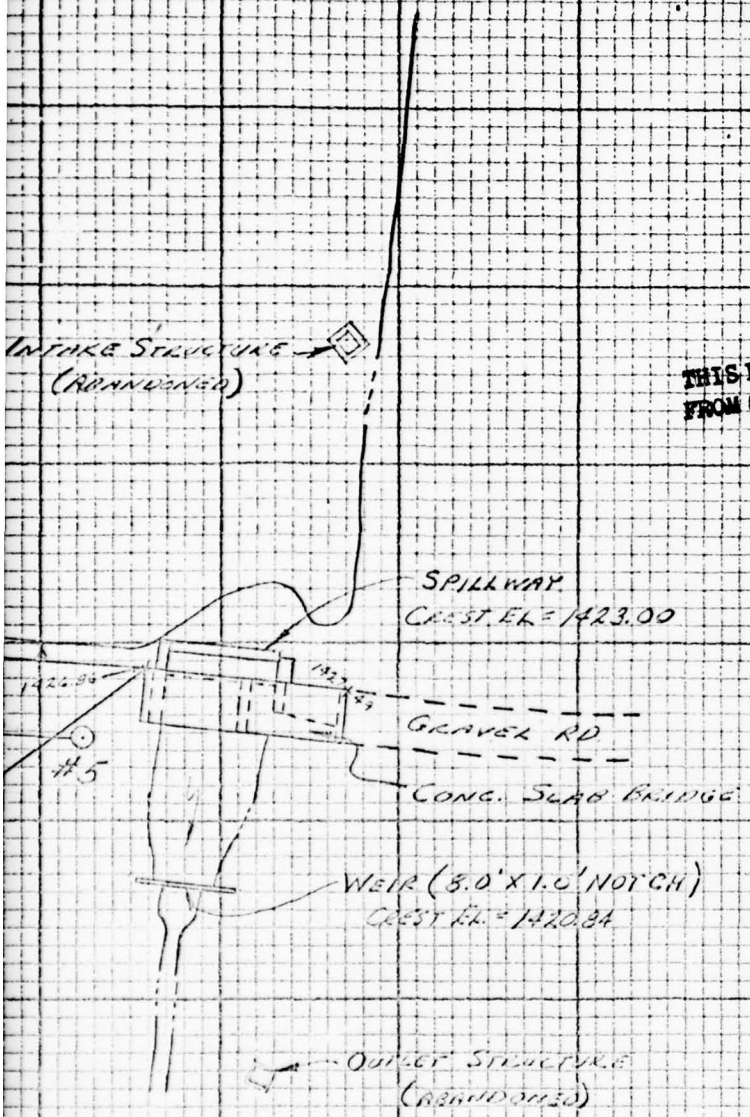


PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

EISENHUTH DAM

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PLAN AND SECTION

AUGUST 1978 PLATE 2

5

DELAWARE RIVER BASIN

EISENHUTH RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

EISENHUTH DAM

NDS ID No. PA-00662
DER ID No. 54-55

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: Eisenhuth

NDS ID NO.: PA-00662 DER ID NO.: 54-55

ITEM	REMARKS
AS-BUILT DRAWINGS	Construction drawing only for reconstruction of south spillway bridge in 1962.
REGIONAL VICINITY MAP	Project is shown on Shenandoah, Pennsylvania, Quandrangle Sheet N4045-W7607.5/7.5, 1955 Photo revised 1969.
CONSTRUCTION HISTORY	Built in 1874 for the Pottsville Water Company. Designer and constructor unknown.
TYPICAL SECTIONS OF DAM	None.
OUTLETS: Plan Details Constraints Discharge Ratings	No information available.

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	No detailed operation records.
SPILLWAY: Plan Sections Details	1962 plans for reconstruction of south spillway roadway bridge shows approximate dimensions of south spillway.
OPERATING EQUIPMENT: Plans Details	Unavailable.
PREVIOUS INSPECTIONS Dates Deficiencies (Continued on page A-5)	1918: Initial inspection and description by Commonwealth. No deficiencies noted. 1922: Brush and small tree growth in spillway and wasteway channel. 1924: (By Owner) clear seepage at bottom of embankment; discharge is 131,000 gallons per day - same amount of seepage reported since 1883. 1926: Seepage all along downstream toe. 1930: Small stream collects seepage near the outlet pipe; brush at both spillways and wasteway channels; actual spillway measurements: north spillway - 40 feet long and 2 to 3 feet deep, south spillway - 36 feet long and 4.5 feet deep; there is accumulation of earth at the right end of the north spillway channel. 1933: Numerous small bulges of riprap face along left half embankment - fill under riprap is wet at some bulges; lower toe wet along left half; small flow

ITEM	REMARKS
PREVIOUS INSPECTIONS (Continued from page A-4)	flow in ditch below valve house - seepage at valve house and along toe 20-50 feet to left - moderate flow from toe drain terminating 100 feet left of valve house - drain shows up at other points along the toe; brush in spillways and in south wasteway channel. 1938: Several small gullies in crest toward upstream face; bulges in riprap along left half of dam; flow of water in drain ditch about 15 feet below toe of dam; small flow under valve house; seepage along toe about 20-50 feet to left of valve house; bridge bent in spillway channel - roadway bridge across left spillway to be repaired; evidence that brush had recently been cut - some brush remains at lower end of wasteway channel. 1941: Gullies on crest and upstream face from roadway drainage; small brush on downstream face; small flow from under valve house; flow along drain about 15 feet below lower toe; flow starts approximately 200 feet to the left of the valve house; uneven spillway crests; bridge pier in left spillway; left wasteway channel full of brush. 1945: Number of small gullies on the crest and upstream face of the embankment from drainage from roadway on the crest; small amount of seepage from valve house; some flow in open ditch about 15 feet below lower toe; flow starts from 150-175 feet to the left of the valve house; both spillway crests uneven; bridge pier in left spillway; some brush in left spillway channel. 1962: Seepage 15' below valve house and 200 feet left; north spillway has been poorly maintained - crest is partially washed out, a load of earth has been dumped into spillway and there is an earth road across the wasteway with a pipe under it; left spillway wasteway channel has trees

ITEM	REMARKS
PREVIOUS INSPECTIONS (Continued from page A-5)	growing in it. 1971: North spillway is poorly maintained and has some brush growth; two pipes have been provided along the spillway and across the earth road at the right end; lower toe is wet at about 200 feet left of valve house and approximately 50 feet on both sides. 1972: Discharge from north spillway eroded a gully along downstream toe; no real definable spillway crest; north spillway is choked with growing weeds and brushes; constriction at north spillway by pipe culverts beneath a bridge; very wet and spongy seep area near valve house; gully 2-5 feet deep and 600 feet long on right side.

CHECKLIST

ENGINEERING DATA

HYDROLOGY AND HYDRAULICS

NAME OF DAM: Eisenhuth NDS ID NO.: PA-00662 DER ID NO.: 54-55

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): El. 1423.0.

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): El. 1425.4.

ELEVATION MAXIMUM DESIGN POOL: El. 1425.4.

ELEVATION TOP DAM: El. 1425.4.

SPILLWAY CREST:	Left Spillway	Right Spillway
a. Elevation	1423.0	1423.0
b. Type	Open channel excavated to rock	Open channel excavated to rock
c. Width	2.0 feet	3.0 feet
d. Length	31.5 feet	38.9 feet
e. Location Spillover	Left abutment	Right abutment
f. Number and Type of Gates	None	None

OUTLET WORKS:
a. Type One active and one abandoned water supply line.
b. Location Near middle of embankment.
c. Entrance Inverts Unknown.
d. Exit Inverts None.
e. Emergency Draindown Facilities Water supply line only.

HYDROMETEOROLOGICAL GAGES:
a. Type Nonrecording rainfall gage.
b. Location Yard of caretaker's home.
c. Records Caretaker has recorded data from gage for 15 years.

MAXIMUM NONDAMAGING DISCHARGE: 710 cfs

DELAWARE RIVER BASIN

EISENHUTH RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

EISENHUTH DAM

NDS ID No. PA-00662
DER ID No. 54-55

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: Eisenhuth County: Schuylkill State: Pennsylvania

NDS ID No.: PA-00662 DER ID No.: 54-55

Type of Dam: Earth Embankment Hazard Category: High

Date(s) Inspection: 17-18 July 1978 Weather: Generally overcast Temperature: 80°F

Camera 1: Canon FT6 with 35 mm lens and Kodachrome 64 color slide film.

Camera 2: Minolta SR-T 101 with 28 mm lens and Plus-X black and white print film.

Pool Elevation at Time of Inspection: 1421.5 msl/Tailwater at Time of Inspection: None msl

General Soil Condition: Dry

Inspection Personnel:

A. H. Whitman, Jr. (GFCC)

D. R. Ebersole (GFCC)

J. Hower (SCMA)

J. M. Crouse (GFCC) Recorder

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Upstream and downstream slopes are rock lined. No surface cracks on crest.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	See Riprap Failures below.	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	See Riprap Failures below.	
CREST ALIGNMENT: Vertical Horizontal	Vertical: alignment uneven. Horizontal: top width of dam vanes from 29' to 41'.	Top of dam elevation varies from 1425.4 to 1427.4. Largest pool of standing water on crest is 45' long, 15' wide and 2" deep.
RIPRAP FAILURES	Bulging of riprap on donwstream face around the lower portion of the embankment at several places near the valve house. Typical bulge is 4" high, 3' wide and 8' long.	Sparse brush 2-1/2' high on downstream slope of embankment. Very sparse brush 2' high on upstream slope of embankment.

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	No abnormalities at spillways or abutments. There are large, mature trees immediately below the downstream toe of embankment from the valve house to the left spillway.	There is a line of telephone poles at the downstream toe of embankment for the entire length of the dam.
ANY NOTICEABLE SEEPAGE	Three seepage areas were observed: The first seepage area is downstream of the toe of the embankment and is to the left of the valve house. an area 200' (Continued Below)	The first seepage area drains partially into the drainage ditch described below and partially directly into the old streambed of Eisenhuth Run. Seepage is clear and the total discharge from the
STAFF GAGE AND RECORDER	None.	
DRAINS	Drainage ditch parallel to the embankment at the downstream toe to the left of the valve house. Ditch is approximately 4' wide and 1-1/2' deep and varies in size along toe. Flow in ditch is intermittent; at times, flow is under the surface.	Ditch collects seepage from the seepage area downstream of the toe to the left of the valve house. Ditch runs towards valve house and turns 90° to the left and empties into the original streambed of Eisenhuth Run.
ANY NOTICEABLE SEEPAGE (Continued from Above)	wide and 350' along the toe is generally wet and spongy. The second seepage area is down- (Continued on page B-11)	first seepage area is 30 to 40 gpm The second seepage area drains into a few holes in the ground that

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Blowoff line has been abandoned See EMERGENCY GATE below. Water supply lines are cast-iron pipe. Two water supply lines one 12" on the right and one 10" on the left, are visible below the valve house.	The left water supply line has been abandoned and terminates about 250' downstream of the dam There is an abandoned pump house and appurtenance works near the area of the termination.
INTAKE STRUCTURE	Two intake structures exist. The intake for the blowoff line had been damaged by ice and has been abandoned. The intake for the water supply lines was submerged and the condition is unknown.	
OUTLET STRUCTURE	The valve house was locked. The key to the lock on the door failed to open the lock. The contents of the valve house are unknown.	Any valve on the right water supply line is at least partially open. Apparently, water supply regulation is obtained by operating a valve about 24'feet downstream of the valve house.
OUTLET CHANNEL	The abandoned blowoff line had emptied into the left spillway channel.	
EMERGENCY GATE	Owner reported that the intake structure for the blowoff line had been damaged by ice many years ago and the blowoff line has been abandoned.	No present emergency drawdown facilities exist.

LEFT
UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MASONRY WEIR	Masonry weir is sound and intact. Concrete apron immediately downstream of masonry weir is undermined at downstream end. Apron is undermined a length of 15', a vertical depth of up to 8", and a distance of 1-1/2' upstream.	Small amount of clear flow under concrete apron of about 1/4 gpm. Small pool (10'x5'x4") of standing water in channel by pier. Concrete apron was placed on weak shale and portions of the shale have eroded.
APPROACH CHANNEL	Approach channel is shallow and clear.	
DISCHARGE CHANNEL	Channel immediately below bridge is choked with very dense woods and brush. Average height of brush is 3 feet.	Weak, red shale found in discharge channel below concrete weir.
BRIDGE AND PIERS LEFT UNGATED SPILLWAY (Continued on page B-11)	Bridge deck: There are differential movements of 3/8", 1/2" and 3/4" between the first and second, second and third, and third and fourth concrete monoliths from the upstream side, respectively. Top surface of deck and bridge pier: no abnormalities. Bottom surface of deck: Three tension cracks were observed	The downstream monoliths are lower than the upstream monoliths. The bridge could act as a hydraulic control during periods of high discharge. No differential movement at any crack. Cracks are 1/8" wide and

RIGHT
UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MASONRY WEIR	Masonry weir has small concrete cap sections in several places for leveling purposes.	The hand placed riprap apron immediately below the masonry weir is generally in good condition. There is minor brush growth through the riprap and heavier brush starting at the toe of riprap.
APPROACH CHANNEL	The approach channel is generally shallow and relatively clear with minor debris present.	
DISCHARGE CHANNEL	Large tree with 8" diameter and 35' height near junction of riprap apron and right abutment in spillway channel. Small trees up to 2" dia. and 12' height in channel. 50% of channel covered with brush of 2-1/2' height	
BRIDGE AND PIERS	No bridge or piers, but an earthen roadway embankment crosses the spillway channel about 85' downstream of the masonry weir. Two 18" C.I. culverts pass through embankment.	Roadway embankment may influence discharge capacity of spillway. erosion pit 2' deep at outlet of culverts below roadway embankment. Scattered cebris in channel downstream of culverts.
DISCHARGE CHANNEL BELOW ROADWAY EMBANKMENT	About 50' downstream of the culvert outlet, flow in the outlet channel has cut a relief channel that rejoins the outlet channel about 40' further downstream.	About 40' below the point where the relief channel rejoins the outlet channel, there is an area of erosion that is 8' wide, 3' deep, and 15' long, where channel overflows have scoured the channel bank as they emptied back into the outlet channel.

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	A concrete weir had been constructed about 44 feet downstream of the bridge over the left spillway channel, apparently to enable measurements of spillway channel flows.	The Owner said that measurements were no longer made at the concrete weir. Concrete weir may influence discharge capacity of spillway. Top of weir is spalled to a depth of 1" over a 28" x 12" area.
PIEZOMETERS	None.	
OTHER	Three drill hole casings with caps were observed at the downstream toe of embankment. The caps were not able to be removed.	The Owner said that the holes had been drilled in 1930-1932 for a study to raise the embankment. Boring records have since been destroyed.

RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Steep to moderate slopes; no evidence of creep, rock slides, or land slides.	
SEDIMENTATION	No sediment problem reported by Owner.	
WATERSHED DESCRIPTION	Predominately controlled and forested; minor development.	Construction of Interstate 81 involved the transfer of 13 acres of land of the Eisenhuth Dam Watershed to PennDOT form SCMA.

LEFT
DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	The roadway bridge over the left spillway channel and/or the concrete weir 45' downstream of the bridge could reduce the capacity of the spillway. No debris present.	The left downstream channel was excavated to rock for some distance downstream of the concrete weir.
SLOPES	The slope of the left downstream channel is moderate.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	No inhabitable structures are in the immediate vicinity downstream of the dam.	

RIGHT
DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	The roadway embankment across the right spillway channel could reduce the capacity of the spillway. Large discharges in excess of the capacity of the culverts could be diverted towards the downstream toe of the embankment.	The right downstream channel was excavated to rock for some distance below the culverts. After that, it appears that the discharge was permitted to carve its own way downstream.
SLOPES	The slope of the right downstream channel is steep.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	No inhabitable structures are in the immediate vicinity downstream of the dam.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE (Continued from page B-3)	stream of the toe of the embankment and extends from 40' to 100' to the right of the valve house. The area is 10' wide and was probed to a depth of 1'. The third seepage area is about 30' downstream of the valve house. Water is flowing from under the right water supply line, where the line is above the surface of the ground and starts about 6' downstream of the valve in the line.	are 1-1/2" diameter. Seepage is clear, and the total discharge is about 1/2 gpm. The third seepage area drains into the old streambed of Eisenhuth Run. Seepage is clear, and the total discharge is 3 to 5 gpm.
LEFT UNGATED SPILLWAY (Continued from page B-5) LEFT MASONRY TRAINING WALL	running normal to flow - first crack is 8" d/s of first and second monolith joint and is 20' long; second crack is 18" u/s of second and third monolith joint and is 14' long; third crack is 20" u/s of the downstream edge of deck and is 20' long. A 2' wide x 3' high x 12' long section of the left training wall under the bridge is missing. The remaining portion of the wall is undermined 10" horizontally and 6" vertically.	were probed to a depth of 1/4". A 3' x 3' x 3' area is scoured out behind where the missing training wall should be.
RIGHT MASONRY TRAINING WALL (Continued from page B-5)	Longitudinal crack in mortar joint 20" below the top of the wall. Crack runs entire length of wall and is 1/4" wide. No differential movement.	

DELAWARE RIVER BASIN

EISENHUTH RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

EISENHUTH DAM

NDS ID No. PA-00662
DER ID No. 54-55

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

APPENDIX C

HYDROLOGY AND HYDRAULICS

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT EISENHUTH DAM (54-55) FILE NO. 7613.28
HYDROLOGY AND HYDRAULICS ANALYSIS SHEET NO. 1 OF 5 SHEETS
FOR USCE - BALTIMORE DISTRICT
COMPUTED BY JMC DATE 3/27/78 CHECKED BY [illegible] DATE 3/27/78

CLASSIFICATION

HIGH HAZARD, SINCE DOWNSTREAM POPULATION IS SUBSTANTIAL, AND FAILURE OF THE DAM COULD RESULT IN MORE THAN A FEW LIVES LOST AND EXCESSIVE ECONOMIC LOSS

INTERMEDIATE SIZE, SINCE HEIGHT = 45 FEET AND CAPACITY = 1,070 AC-FT
REFERENCE: "RECOMMENDED GUIDELINES FOR SAFETY INSPECTION OF DAMS," p D-8

SPILLWAY DESIGN FLOOD (SDF)

THE SDF SHOULD BE THE PMF (FROM p. D-12 OF "REC. GUIDELINES ...")

HYDROLOGY AND HYDRAULICS ANALYSIS

REFERENCE: PHASE I PROCEDURE PACKAGE

II. A. 2. PMF INFLOW HYDROGRAPH NOT AVAILABLE

a. BALTIMORE CONTACT, MIKE KANOVITZ, RECOMMENDS 1,700 CSM FOR THE PMF PEAK FLOW FOR THE EISENHUTH DAM WATERSHED

PMF PEAK = 1,700 CFS/sq.mi. X 1.97 Sq.Mi. = 3,349 - SAY 3,350 CFS ✓

EFFECT OF UPSTREAM RESERVOIRS

NO UPSTREAM RESERVOIRS EXIST

NOTE: TOP OF RIGHT SPILLWAY WALL IS AT EL. OF LOW SPOTS.

B. ABILITY OF SPILLWAYS TO PASS PMF

1. CAPACITY OF SPILLWAYS -

Design TOP OF DAM ELEVATION	=	NOT AVAILABLE
ACTUAL MINIMUM TOP OF DAM ELEVATION	=	1425.4'
RIGHT (NORTH) SPILLWAY CREST ELEVATION	=	1423.0'
LEFT (SOUTH) SPILLWAY CREST ELEVATION	=	1423.0'
Design HEAD ON RIGHT SPILLWAY CREST	=	NOT AVAILABLE
Design HEAD ON LEFT SPILLWAY CREST	=	NOT AVAILABLE
AVAILABLE HEAD ON RIGHT SPILLWAY CREST	=	2.4'
AVAILABLE HEAD ON LEFT SPILLWAY CREST	=	2.4'

SINCE THE APPROACH CHANNELS FOR BOTH SPILLWAYS ARE NEARLY FLAT AND ARE APPROXIMATELY AT THE SAME ELEVATION AS THE SPILLWAY CRESTS, USE A COEFFICIENT OF DISCHARGE (C) OF 2.7 FOR BOTH SPILLWAYS.

$Q = CLH^{3/2}$; $Q = 2.7 L H^{3/2}$

C-1

ASSUME RECTANGULAR - SHAPED CROSS SECTION FOR FLOW OVER WEIRS

CREST LENGTH OF RIGHT WEIR = 33.3'
CREST LENGTH OF LEFT WEIR = 31.5'

RIGHT SPILLWAY : $Q = 2.7(33.3)(2.4)^{3/2} = 331$, SAY 330 CFS ←

LEFT SPILLWAY : $Q = 2.7(31.5)(2.4)^{3/2} = 316$, SAY 320 CFS ←

TOTAL DISCHARGE CAPACITY = 330 + 320 = 710 CFS ←

3. THE PMF PEAK FLOW IS GREATER THAN THE SPILLWAY CAPACITY (3,350 > 710)

b. ROUTING OF THE PMF IS NOT AVAILABLE

(1.) THE SPILLWAY WILL PASS (710/3,350) = 0.212 = p = 21.2 % OF THE PMF PEAK

(2.) INCLUSIVE 3 METHOD TO ESTIMATE THE STORAGE EFFECT OF THE RESERVOIR

(a) TRIANGULAR SHAPE FOR PMF HYDROGRAPH

(b) ASSUME 24 INCHES OF RUNOFF AS PER INSTRUCTIONS FROM BALTIMORE CONTACT

$VOL = \frac{1}{2} bh$; $b = 2\,VOL/h$

VOL = 24" RUNOFF × 1.97 SQ. MI. × 640 ACRES / SQ. MI. = 30,259 AC-IN

30,259 AC-IN × 1 FT / 12 IN × 43,560 FT²-HR / 3,600 AC-SEC = 30,511 CFS-HRS

$b = \frac{2\,VOL}{h} = \frac{2 \times 30,511 \text{ CFS-HRS}}{3,350 \text{ CFS}} = 18.2$ HOURS

$1 - p = 1 - 0.212 = 0.788 = \Delta AOC / \Delta AOB$

$\Delta AOB = \frac{1}{2} bh = VOL = 30,259$ AC-IN × (1 FT / 12 IN) = 2,522 AC-FT

SUBSTITUTING, $\Delta AOC = (1-p)\,\Delta AOB = 0.788\,(2,522) = 1,987$ AC-FT

REQUIRED STORAGE = ΔAOC = 1,987 AC-FT

(c) INCREMENTAL STORAGE AVAILABLE BETWEEN NORMAL POOL ELEVATION AND MAXIMUM POOL ELEVATION

NORMAL POOL ELEVATION = SPILLWAY CREST ELEVATION = 1423.0'
MAXIMUM POOL ELEVATION = ELEVATION OF OVERTOPPING = 1425.4'
AREA OF RESERVOIR WITH W.S. AT SPILLWAY CREST = 70.4 ACRES
AREA OF RESERVOIR WITH W.S. AT MAXIMUM POOL = ?

ASSUME RESERVOIR SIDE SLOPES OF 4H ON 1V AND ASSUME CIRCULAR SHAPE

70.4 ACRES × 43,560 FT²/1 ACRE = πr_1^2

$976,137\ FT^2 = r_1^2$

$r_1 = 983.0\ FT$

$r_2 = r_1 + \Delta H = r_1 + \frac{1}{4}(\Delta V) = r_1 + \frac{1}{4}(2.4')$

$= 983.0 + 0.6 = 997.6'$

$A_2 = \pi r_2^2 = \pi (997.6')^2 = 3,126,531\ FT^2$

$A_2 = 71.8$ ACRES ✓

INCREMENTAL STORAGE $= \left(\frac{A_1 + A_2}{2}\right) \Delta V$

$= \left(\frac{79.1 + 71.8}{2}\right) 2.4'$

INCREMENTAL STORAGE = 170 AC-FT ✓

STORAGE REQUIRED = 1,987 AC-FT > STORAGE AVAILABLE = 170 AC-FT ✓

C. PROCEDURES FOR DETERMINATION OF ADEQUATE / INADEQUATE SPILLWAY CAPACITY

2. STORAGE REQUIRED FOR THE PMF IS GREATER THAN THE STORAGE AVAILABLE

a. ETL 1110-2- STATES THREE CONDITIONS THAT MUST EXIST BEFORE THE SPILLWAY CAPACITY IS CONSIDERED TO BE SERIOUSLY INADEQUATE. CHECK CONDITION "C." (IS THE SPILLWAY ABLE TO PASS $\frac{1}{2}$ PMF W/O OVERTOPPING FAILURE ?)

b. REPEAT CALCULATIONS FOR $\frac{1}{2}$ PMF PEAK

$\frac{1}{2}$ PMF PEAK $= \frac{1}{2}(3,350) = 1,675$ CFS ✓

II. B. ABILITY OF SPILLWAYS TO PASS $\frac{1}{2}$ PMF

1. CAPACITY OF SPILLWAYS = 710 CFS

3. $\frac{1}{2}$ PMF PEAK FLOW IS GREATER THAN THE SPILLWAY CAPACITY (1,675 > 710)

b. ROUTING OF $\frac{1}{2}$ PMF IS NOT AVAILABLE

(1) THE SPILLWAY WILL PASS $(710/1,675) = 0.424 = p = 42.4\%$ OF $\frac{1}{2}$ PMF PEAK

(2.) INCLOSURE 3 METHOD TO ESTIMATE THE STORAGE EFFECT OF THE REJECTION

(a) TRIANGULAR SHAPE FOR $\frac{1}{2}$ PMF HYDROGRAPH

(b) SAME AS BEFORE, EXCEPT THAT THE PEAK IS NOW 1,675 CFS

$1-p = 1 - 0.424 = 0.576 = \frac{\Delta A_{3C}}{\Delta A_{3B}}$ ✓

$\Delta A_{3B} = \frac{1}{2} bh = \frac{1}{2}(18.2\ \text{HOURS})(1,675\ \text{CFS}) = 15,243\ \text{CFS-HRS}$ ✓

SUBSTITUTING, $\Delta A_{3C} = (0.576)(\Delta A_{3B}) = (0.576)\ 15,243 = 8,780\ \text{CFS-HRS}$

$8,780\ \frac{FT^3}{SEC} \times \text{HOURS} \times \frac{3,600\ \text{AC-SECS}}{43,560\ FT^2\text{-HRS}} = 726\ \text{AC-FT}$

∴ 726 AC-FT IS REQUIRED TO PASS $\frac{1}{2}$ PMF W/O OVERTOPPING

(c) INCREMENTAL STORAGE AVAILABLE BETWEEN NORMAL POOL ELEVATION AND MAXIMUM POOL ELEVATION - SEE SHEET 3 - = 170 AC-FT

STORAGE REQUIRED = 726 AC-FT > STORAGE AVAILABLE = 170 AC-FT

C. PROCEDURES FOR DETERMINATION OF ADEQUATE/INADEQUATE SPILLWAY CAPACITY

2. STORAGE REQUIRED IS GREATER THAN STORAGE AVAILABLE

a. ETL 1110-2-

(1) THERE IS A HIGH HAZARD OF LOSS OF LIFE FROM LARGE FLOWS DOWNSTREAM OF DAM

(2) CHECK TAILWATER AT INSTANT BEFORE OVERTOPPING OCCURS

(3) THE DAM AND SPILLWAY ARE NOT CAPABLE OF PASSING ½ PMF WITHOUT OVERTOPPING FAILURE

b. TAILWATER AT INSTANT BEFORE OVERTOPPING OCCURS

SPILLWAY CAPACITY DISCHARGE = 710 CFS. FROM HEC-2 COMPUTER RUN USING 4 USGS TOPO SHEET CROSS-SECTION DOWNSTREAM OF DAM,

TAILWATER DEPTH @ Q = 710 CFS IS	3.4 FEET	
TOP OF DAM ELEVATION	≈	1427'
HEIGHT OF DAM	=	45'
BOTTOM OF DAM ELEV.	=	1382'
TAILWATER DEPTH	=	3.4'
TAILWATER ELEVATION	=	1385.4'

TOP OF DAM ELEV. - TAILWATER ELEV. = 1427' - 1385.4' = 41.6'

PERCENT OF PMF THAT SPILLWAY CAN PASS

GENERAL FORMULA

$$\%\text{ OF PMF THAT SPILLWAY CAN PASS} = \frac{Q_T}{Q_{PMF}} \times 100\%,$$

WHERE $Q_T = Q_{SPILLWAY} + 2S/\Delta t$,

$S = \sum_{i=1}^{n} S_i$ FOR UPSTREAM RECESSION CURVES

AND T = TOTAL TIME OF PMF HYDROGRAPH

$$\%\text{ OF PMF} = \frac{710 + \left(\frac{2 \times 170\ \text{AC-FT}}{18.2\ \text{HRS}} \times \frac{43{,}560\ \text{FT}^2\text{-HRS}}{3600\ \text{AC-SECS}}\right)}{3{,}350} \times 100\%$$

$$\% \text{ OF PMF} = \frac{710 + 226}{3,350} \times 100\% = \frac{936}{3350} \times 100\%$$

$$\% \text{ OF PMF} = 28\% \checkmark$$

SPILLWAY CONTROL SECTION

DURING THE VISUAL INSPECTION OF EISENHUTH DAM, IT WAS NOTED THAT THE HYDRAULIC CONTROL SECTION OF THE LEFT (SOUTH) SPILLWAY CHANNEL MAY SHIFT FROM THE MASONRY SPILLWAY WEIR TO THE ROADWAY BRIDGE THAT CROSSES THE SPILLWAY, ABOUT 6 DOWNSTREAM OF THE MASONRY WEIR, OR TO THE CONCRETE WEIR THAT IS 44 FEET DOWNSTREAM OF THE BRIDGE. IN ADDITION, THE HYDRAULIC CONTROL SECTION OF THE RIGHT (NORTH) SPILLWAY CHANNEL MAY SHIFT FROM THE MASONRY SPILLWAY WEIR TO THE ROADWAY EMBANKMENT AND TWIN CULVERTS THAT ARE ABOUT 80 FEET DOWNSTREAM OF THE MASONRY WEIR. IN ANY CASE, THE SHIFT OF CONTROL WOULD BE ADVERSE AND WOULD REDUCE THE SPILLWAY DISCHARGE. ANALYSIS OF SUCH A SHIFT OF CONTROL IS BEYOND THE SCOPE OF WORK OF THIS PHASE I STUDY. HOWEVER, THE ABOVE FACTORS SHOULD BE INVESTIGATED IN ANY FURTHER, MORE DETAILED, STUDIES OF THE TOTAL SPILLWAY CAPACITY OF EISENHUTH DAM.

DELAWARE RIVER BASIN

EISENHUTH RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

EISENHUTH DAM

NDS ID No. PA-00662
DER ID No. 54-55

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

APPENDIX D

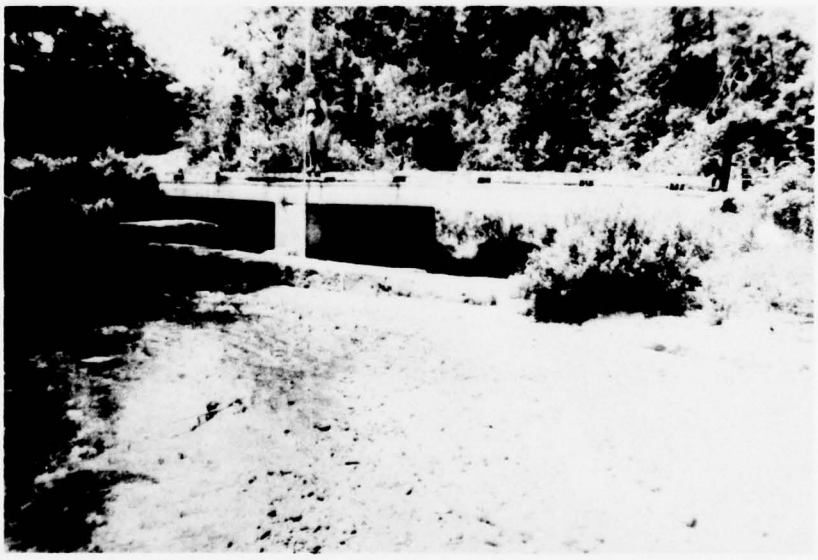
PHOTOGRAPHS

EISENHUTH DAM

A. Riprap on Upstream Slope of Embankment.

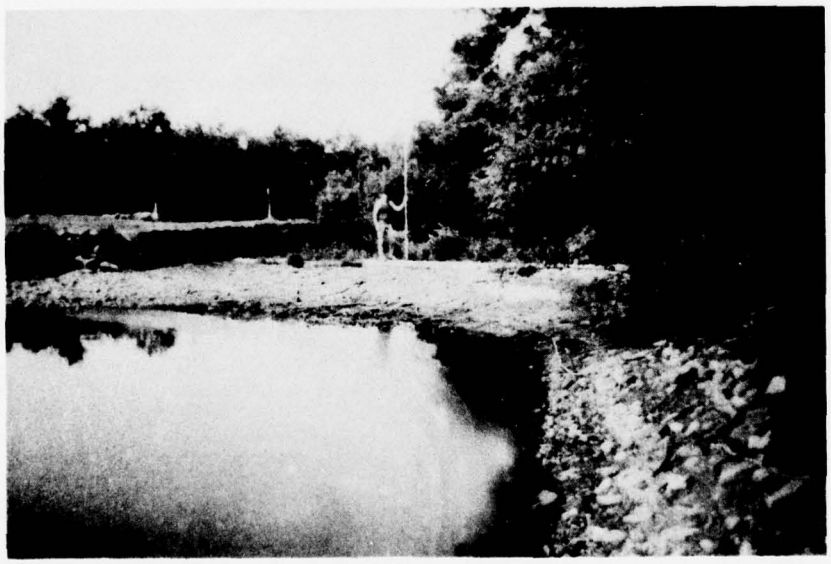
B. Embankment from Right Abutment.

C. Downstream Toe of Embankment and Bulging of Riprap.

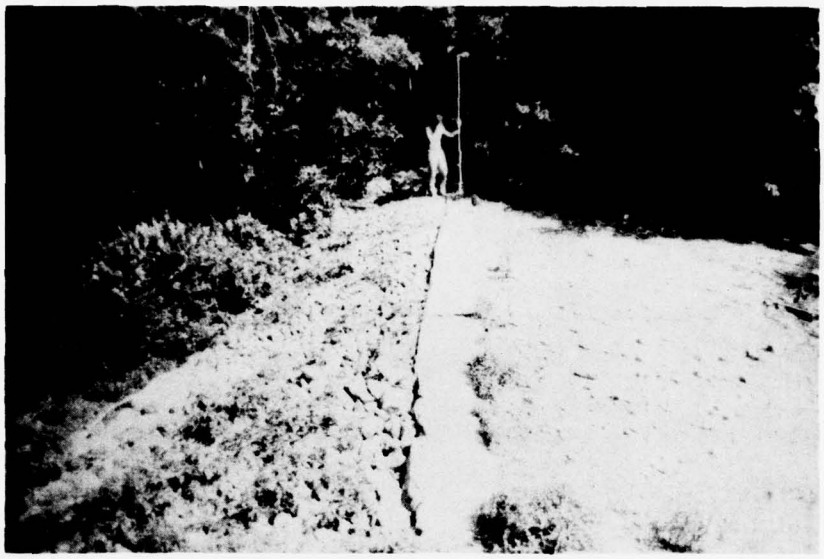


D. Left Spillway Approach Channel,
Masonry Weir, and Roadway Bridge.

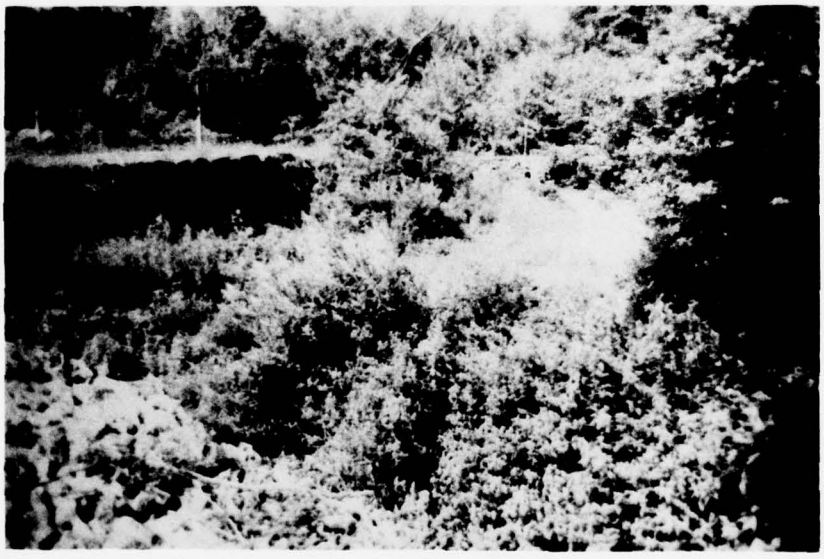
E. Left Spillway Outlet Channel and Concrete Weir — Looking Downstream.



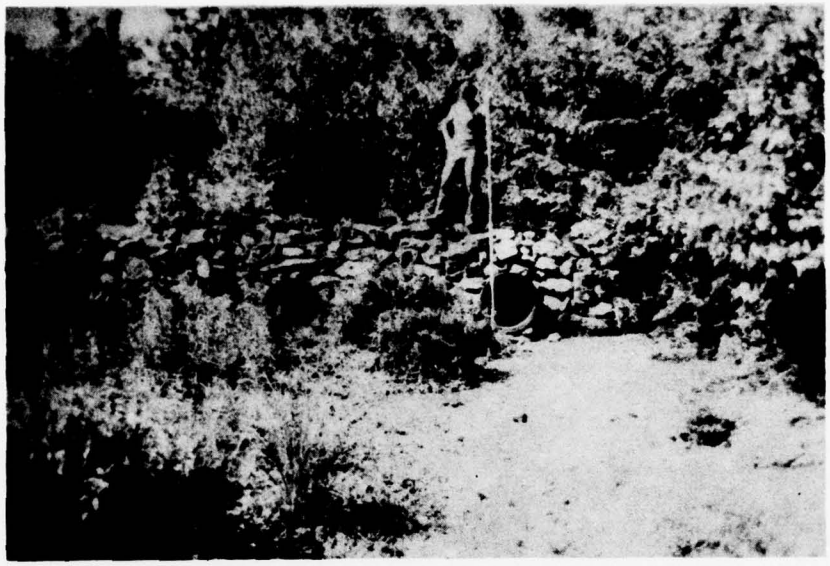
F. Right Spillway Approach Channel and Masonry Spillway Weir.



G. Right Spillway Masonry Weir —
Looking Towards Right Abutment.



H. Right Spillway Outlet Channel —
Looking Downstream.



I. Roadway Embankment and Culverts at Downstream End of Right Spillway Outlet Channel.

J. Right Spillway Outlet Channel (left) and Relief Channel (right) — Looking Downstream.

K. Wet Area Downstream of Toe.

L. Drainage Ditch Downstream of Toe.

DELAWARE RIVER BASIN

EISENHUTH RUN, SCHUYLKILL COUNTY

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APPENDIX E

GEOLOGY

EISENHUTH DAM

APPENDIX E

GEOLOGY

1. General Geology. The dam and reservoir are located in Schuylkill County. The county lies entirely south of the Wisconsin and Illinoian drift borders. The Jerseyan drift border is believed to traverse the middle of the county, but very few definite deposits of drift have been located. The rock formations exposed in Schuylkill County range from the post-Pottsville formations, of Pennsylvania age, down to the Tuscarora sandstone, of Silurian age. The youngest formations, the post-Pottsville, crop out in the large Southern anthracite field and part of the Western Middle field. The oldest formation, the Tuscarora, crops out along Kittatinny (Blue) Mountain which forms the southern boundary of the county.

The geologic structure of Schuylkill County is complex. The strata have been sharply folded along northeast axes, and the truncated hard and soft beds now form an intricate system of long narrow ridges and valleys. The carboniferous rocks suffer the most intense folding and are overturned in many places. The most important structure feature economically is the large synclinorium of the Southern anthracite field which occupies the center of the county. This basin consists of a number of smaller connected basins, which become successively deeper and have steeper sides as they progress towards the south. In the southern part of the county, the Silurian and Devonian rocks have been folded for some distance on both sides of the Schuylkill River. An anticline passes eastward from Cressona, exposing the Cayuga group and part of the Clinton formation. A syncline extending west from Landingville exposes the Catskill group. The Lehighton anticline of Carbon County extends into Schuylkill County as far as Reynolds. The ridge north of Port Clinton is an anticlinal ridge exposing the Clinton formation, and a syncline crosses the Schuylkill River just north of Port Clinton exposing the Cayuga group.

The geology produces a complex runoff pattern in Schuylkill County whereby there is drainage in five different directions. The northwestern part is drained by

Mahantango Creek, and smaller streams, all of which drain into the Susquehanna River north of Harrisburg. The southwestern part is drained by Swatara Creek, which drains into the Susquehanna River south of Harrisburg. The northernmost part is drained by Catawissa Creek, which drains into the North Branch of the Susquehanna River upstream of Danville. The eastern portion of the county is drained by tributaries of the Lehigh River, which in turn drains into the Delaware River near Easton. The central and greater part of the county is drained by tributaries of the Schuylkill River, which, in turn, drains into the Delaware River near Philadelphia.

2. Site Geology. The damsite is underlain by gray soft disintegrated pebble conglomerate interbedded with hard, red, sandy shale stratifications of the Mauch Chunk formation in the highly faulted and folded Soutnern anthracite field in the center of the county. The area is drained by the Schuylkill River. The axis of an anticline called Eisenhuth anticline follows the approximate original streambed through the damsite and reservoir. About 1/2 mile to the right of Eisenhuth anticline, the Frackville fault disturbs and disjoints the continuity of several synclines and anticlines over a wide area. The axis of Locust Lake syncline is located about 1/2 mile to the left of Eisenhuth anticline. A major fault, Mill Creek fault, passes the damsite just beyond the left abutment of the dam. No construction reports were available now or when the first inspection was made by engineers of the Pennsylvania Water Supply Commission in 1918, so the effect of the fault on the construction is unknown.

The embankment has a clay core, instead of either a concrete or masonry core wall as was usual practice during that period of dam construction. Size of clay core or other details of construction are unknown.